

**Advisory Committee on Health Research**

***Health Research Strategy***



**WORLD HEALTH ORGANIZATION**



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ADVISORY COMMITTEE ON HEALTH RESEARCH  
(ACHR)

Health Research Strategy

for Health for All by the Year 2000

Report of a Subcommittee of the ACHR

WORLD HEALTH ORGANIZATION

GENEVA

1986



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## FOREWORD

This report is the outcome of a study sought by the Director-General from the Advisory Committee on Medical Research (ACMR)<sup>1</sup> two years ago to outline for the Organization a fresh approach to health research strategy. The ACMR charged a subcommittee under the chairmanship of Professor T. McKeown to undertake this difficult and exciting task. The subcommittee's report which bears the stamp of Professor McKeown's scholarship and philosophy was discussed by the ACMR in October 1984, it was presented at regional ACMRs and the suggestions so received were incorporated to the extent possible in the report of the subcommittee. The report was finally endorsed by the ACMR in October 1985.

This is an upstream report, conceptual in nature; downstream elements such as tactics, operations, programmes and projects are not its prime concern, although it is inevitable that the report makes frequent excursions downstream. The report casts its observations against the backdrop of WHO's own unique role in research on account of its wider vision, its larger responsibilities and its historical and international perspectives.

The report sees health development in a historical and evolutionary perspective. Diseases are dealt with according to their origins rather than their mechanisms.

Practical goals are set for achieving in the Third World in one and a half decades what took one and a half centuries in the industrialized world. The report reflects both the urgency and the complexity of the task.

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<sup>1</sup> The Advisory Committee on Medical Research (ACMR), which was established in May 1959 by the Twelfth World Health Assembly "in order to provide the Director-General with the necessary scientific advice in relation to the research programme", has been renamed "Advisory Committee on Health Research" (ACHR) by a decision of the Thirty-ninth World Health Assembly in May 1986

No report of such a sweep can be considered as final. It is therefore intended to have this report disseminated widely, to have it discussed in several forums at global, regional and national levels and thus generate a debate which will contribute to the further evolution of the ideas and concepts propounded. The ACHR hopes that launching of this report will mark the beginning of a continuous refinement and retuning of research strategies to enable countries to establish health development programmes leading to socially and economically productive lives for all their people.

Professor V. Ramalingaswami  
Chairman of the Advisory Committee on  
Health Research



## EXECUTIVE SUMMARY

### INTRODUCTION

Since its foundation, WHO has recognized that health is more than the absence of disease, a state of complete physical and mental wellbeing which results when disease-free people live in harmony with their environment and with one another. This concept keeps before governments and the public the understanding that health is not something which can be achieved exclusively by the traditional health services; it is profoundly influenced by conditions of life. The value of this interpretation is in no way diminished by recognition that it defines a long-term objective, one which largely depends on advances not within the control of health administrations: elimination of poverty; universal education; full and rewarding employment; and, perhaps most important of all, avoidance of nuclear war.

The short-term aim was identified by the Thirtieth World Health Assembly, the goal of health for all by the year 2000 (HFA). This concept has been described in numerous publications and is summarized in Annex 1.

As present health levels vary widely between countries, no single standard can be set for the year 2000, and the HFA goal is necessarily stated in general terms: to achieve a substantial improvement in health in all countries, particularly in those where the need is greatest. However, it is not unrealistic to define more precisely a level of health below which it is hoped that no country will fall: infant mortality of 50 (per 1000 live births) and life expectation at birth of 60 years.

A research strategy is approached by considering four questions.

1. How does disease arise?
2. In the light of knowledge of its origins, how can disease be prevented, or where this is not possible, managed in other ways?
3. What kinds of research are needed for prevention or management of disease?



4. What should be the role of WHO within the total research framework?

The report presents evidence for regarding disease, with some well-defined exceptions, as in principle preventable by modification of ways of life. In this context "ways of life" is a synonym for its two components, environment and behaviour, and the report discusses their influence in each of the major disease classes.

## DETERMINANTS OF HEALTH

A fundamental issue confronting research in the health sector is evaluation of two approaches to the problems of disease, one through control of disease origins, the other through intervention in disease mechanisms. And as both are needed, what is wanted is a decision about the distribution of effort between them and, so far as possible, recognition of the kinds of problems with which each is likely to be successful. For the purpose we require a classification of diseases, not on the conventional physiological or pathological lines, but according to disease origins. Such a classification is needed to provide insight into the means and feasibility of disease control.

1. Prenatal diseases determined at fertilization

The conditions determined at fertilization are mainly the single gene defects and chromosomal aberrations, but they include others, particularly associated with aging, which are also independent of environmental influences. It is unlikely that they include any of the so-called "common diseases".

2. Prenatal diseases determined after fertilization

These diseases are not established irreversibly at fertilization and must be determined by other influences during intra-uterine life. They fall broadly into two groups.

Some of the abnormalities arise very early in pregnancy and are probably the result of hazards associated with implantation and early embryonic development.

The other abnormalities are quite different, in that they result from well recognized causes (e.g. malformations caused by rubella and thalidomide; diseases attributable to iodine deficiency during pregnancy, those caused by radiation and possibly tobacco and drugs and conditions resulting in low birth weight).



### 3. Postnatal diseases due to deficiencies and hazards

For most of his existence, man has suffered from direct or indirect effects of food deficiency. The improvement in the food supplies through the first agricultural revolution 10 000 years ago led to an increase in population size which in turn created the conditions for spread of infectious diseases.

As a result of major improvements in nutrition and hygiene during the last few centuries, diseases due to deficiencies and hazards are no longer the principal cause of sickness and death in developed countries. In much of the world, however, the picture remains essentially unchanged. Infectious disease is still the predominant cause of death, and malnutrition, defective hygiene, and excessive growth of populations are the major influences.

### 4. Postnatal diseases due to maladaptation

Several lines of evidence suggest that the disease pattern now predominant in developed countries (e.g. cardiovascular diseases and cancer) is due essentially to recent changes in conditions of life.

Many are influences over which the individual has little control: atmospheric pollution; chemicals used in industry, agriculture and as food additives; adverse working conditions; road traffic; radiation from nuclear processes; risks associated with medical investigation and treatment. Other hazards are from changes in behaviour, many of which are made possible or encouraged by the affluence which resulted from industrialization: smoking; sedentary living; use of drugs; excessive or ill-balanced diets. Hence some of the contemporary health problems can be resolved by public action, whereas others require also modification of behaviour.

## THE RESEARCH STRATEGY OF WHO

The role suggested for WHO is primarily directed to the following areas:

- The first priority should be to encourage and assist research which will raise the standard of health in developing countries and in certain deprived sub-groups of developed countries. The steps needed are well known -provision of sufficient food, clean water, sanitary facilities, limitation of fertility and immunization against some of the common infections- and the research required is essentially of the health systems type. It is probably true to say

that if these basic steps were implemented throughout the world by the year 2000, one of the most important aspects of health for all would be achieved even if nothing else were done; if these measures are not implemented HFA will not be achieved whatever else is done. The effectiveness of these measures is already evident from the rapid progress recently made in some developing countries.

- Improvement in the health of developing countries also requires advance in knowledge of diseases characteristic of the tropics. They differ from the conditions referred to under 1 in that they do not respond adequately to a rising standard of living, and basic knowledge required for their control is still lacking. They therefore need to be tackled with all the research resources that can be brought to bear on their prevention and treatment.

- Second only to the primary goal (discussed above) should be promotion of research on the non-communicable diseases, predominant in developed countries and now threatening to advance in developing countries which are at risk of having the worst of both worlds. In some, the influences, such as smoking and alcohol, are well known, and the research needed is largely of an applied kind. But in many diseases the hazards have not yet been identified, and the research required is essentially epidemiological, to unravel the disease origins. In these diseases the predominant influences are behavioural.

- Even if progress in prevention is as rapid as we would like it to be, the treatment and care of the sick will continue to be of the highest importance. On the most optimistic assumptions it will still be necessary to care for patients with disabling and life-threatening illnesses, as well as with the many kinds of morbidity which diminish the quality of life from day to day.

- A further requirement is for research on health services that address the critical determinants of health (health systems research). The precepts of HFA imply that such services cover entire populations, particularly the most vulnerable individuals and groups. The research questions are formidable: how to join with policy makers and communities in assessing needs, planning, financing and implementing programmes, and evaluating them in terms of coverage, efficiency and effectiveness. Health services, to a substantial extent are specific to local circumstances - traditions, resources, politics, culture - and it is necessary, therefore, that there be local capability for this kind of research. This calls attention to the need for the development,



organization and support of research on the delivery of health services, which requires, in turn, national, regional and international collaboration.

## CONCLUSIONS

Against the background of the preceding analysis the following are the steps which are likely to lead to rapid advance.

- (1) Control of diseases associated with poverty. The research needed is essentially of the health systems type, as the effective measures are well known.
- (2) Control of diseases, both infectious and non-communicable, specific to the tropics. These diseases should be attacked with all the resources - laboratory, clinical and epidemiological - that can be brought to bear on them.
- (3) Control of diseases associated with affluence. In some, the major influences (tobacco, alcohol, occupational hazards, etc.) are already known and the research required is of the applied type; in others, the influences are unknown and research, mainly epidemiological, is needed into disease origins.
- (4) Treatment and care of the sick. Even on the most optimistic assumptions about disease prevention, it will be necessary to make extensive provision for the treatment and care of the sick. For this we rely mainly on biomedical research (which also, of course, contributes powerfully to the preventive measures).
- (5) Delivery of health services. The critical determinants of health must be addressed through health services that are relevant to local needs and cultures and also aim at covering entire populations, particularly the most vulnerable groups. How to join with policy makers and communities in assessing needs, planning, financing and implementing programmes and evaluating them in terms of coverage, efficiency and effectiveness is the challenge to research workers.

The application of these principles will inevitably differ between Regions and between countries within the same Region, according to many variables: the nature of the predominant health problems; the present level of health; economic resources; cultures, political and religious traditions. However, the objective should be common to all: to do the kinds of research which will make it possible to advance rapidly to the HFA goal.





STATEMENT BY PROFESSOR T. McKEOWN,  
CHAIRMAN OF THE SUBCOMMITTEE  
ON HEALTH RESEARCH STRATEGY

At the 1983 meeting of the Global Advisory Committee on Medical Research the Director-General urged the Committee to seek a fresh approach to health research strategy. It was both a difficult and an exciting challenge: difficult because of the size and complexity of the subject; exciting because the opportunity to interpret health and research requirements at global level comes at a time, perhaps the first time, when such an attempt can profitably be made.

The first task of the Subcommittee was to decide in what way the problem should be tackled. One possibility would have been to seek the advice of large numbers of experts from different fields of medical science. This would have resulted in an impressive list of research projects, but would have left open decisions on priorities between them.

Another possibility was to take the objectives already outlined in numerous WHO publications and to concern ourselves essentially with their implementation. In a sense it might be said that this is what we have done, for our proposals are quite consistent with the "health for all" and primary health care concepts accepted at the international conference in Alma-Ata in 1978. However, it is not a criticism of these concepts to say that while they reflect admirably the spirit and intentions of Alma-Ata, they are mainly written in general terms which need to be developed in specific proposals.

Our report has been prepared from one presented to the ACMR in 1984, revised and extended in the light of discussions with the regional ACMRs and the staff of WHO. We have aimed to preserve the basic approach of the original paper, while amending certain points and providing fuller treatment of subjects which had received insufficient attention. Among the additions are assessments of the scope and prospects of biomedical research, of the significance of behaviour in relation to health, and of the contribution that health systems research can make to delivery of services.

Questions have been raised on several occasions about positive health, a subject which was thought to have been understated in our first report because of its emphasis on disease prevention. We hope we have left no doubt about

our recognition of the importance of positive health, as reflected both in WHO's general aims and in the work of some of its divisions. But it is a false antithesis to regard disease prevention and positive health as in conflict, for in practice it will be found that the measures which contribute to the one- for example, relief of poverty, improvements in diet, elimination of smoking- all contribute powerfully to the other. Whether the emphasis is on disease prevention or positive health is, therefore, largely a matter for judgement according to particular circumstances. A mother may well be influenced by an appeal for the health of her children, whereas a smoker is more likely to respond to concern about the risk of disease.

We have re-examined our interpretation of the aims of "health for all" and have restated it in terms which appear to be generally acceptable: that is to say we have suggested a lower limit of health below which it is hoped no country will fall by the year 2000, while recognizing that the upper limits which can be reached in a short period will vary considerably according to the different conditions in countries and Regions.

At the outset we have stated that the report is concerned with strategy at the highest level, with what needs to be done rather than the means by which it can be done. Of course the means are very important, and inevitably questions have been asked about the steps which would follow from the proposals. Nevertheless, it has seemed desirable at this stage to seek agreement about objectives, before considering in detail the issues which would arise from their implementation.

I turn now to examination of the report itself. I believe it would be agreed that a global statement on strategy should have certain characteristics if it is to meet the Director-General's challenge and serve a useful purpose in the enormously varied conditions under which it would be applied. We suggest that it should be large in concepts, clear in objectives and flexible in operation.

### CONCEPTS

I think it is unlikely to be said that the report is not large in concept; indeed a cynic might say it is unnecessarily large, that the viewpoint is not merely global but celestial. Was it really necessary to consider the health of other animals in their natural habitats; to examine the major changes in



conditions of life and health from the beginning of human life to the present day; and to prepare a comprehensive classification of diseases according to their origins as a basis for decisions concerning strategy?

If a research agenda is to be written in other than general terms it seems essential to have a rational basis for classifying diseases according to the nature of the problems they present. The preparation of such a classification requires knowledge of the major influences - biological and environmental - which led to disease in the past. And the information about the health of other animals, particularly primates, in their natural habitats throws light on human experience in the long hunter-gatherer period for which evidence is seriously deficient.

The present time is, arguably, the first in history when such an approach to research planning can usefully be made. Before the nineteenth century ideas concerning disease origins were, to say the least, confused. Many people denied a relation between living conditions and health, for although it had long been evident that people who are sick are often poor, it has not always been recognized that many of them are sick because they are poor. It was thought that the sick poor were, in some ill-defined way, intrinsically inferior, and that an improvement in their circumstances would have little effect on their health and, perhaps, only a temporary effect on their poverty. In preferring £5 he would be happy to spend to £10 he would be unhappy to save, Mr Doolittle in Shaw's Pygmalion would have been regarded as typical of people for whom little could be done in health or wealth by public action.

The nineteenth century removed such ideas for infectious diseases. But for noncommunicable diseases the same notions persisted until the second half of the twentieth century, and it is only in the last few decades that evidence of their environmental origins has accumulated to the point where it can no longer be seriously disputed.

The health scene can now be likened to a large and complex jigsaw puzzle, of which at last enough pieces are visible to enable them to be fitted into a meaningful whole. Many sources contribute to the picture, but the following are among the key discoveries.

1. Recognition that human genetic constitution is much the same today as it was a hundred thousand years ago, before the advent of any form of pastoral or agricultural activity. That is to say we now face vastly changed conditions of life with the genetic equipment of hunter-gatherers.
2. The finding that in developed countries the modern transformation of health, and the associated increase of populations, began more than a century before effective medical intervention was possible, and must therefore be attributed largely to improvements in living conditions.
3. The discovery by medical science of the nature of infectious disease and of the possibility of its prevention by environmental measures and immunization.
4. Recognition in the last few decades that most noncommunicable diseases are also preventable by changes in living conditions and behaviour. Perhaps the most striking evidence is the recent decline of coronary deaths and the finding that most cancers are potentially preventable.

This is the background of the classification of diseases proposed in our paper. Its purpose is to group diseases according to their origins in such a way that we can judge the kinds of research needed if they are to be controlled. The contribution suggested for WHO within the total research framework is determined primarily by its commitment to rapid advance in health, particularly in countries where the need is greatest.

### OBJECTIVES

The second characteristic suggested for a research strategy is that it should be clear in its objectives. Before discussing them, however, I should make two general points. The first is that the number of subjects for research related to health for all is very large, and the number related to health problems as a whole is almost infinite. The second point is that in WHO a great deal of thought has already been given to health-related research, and there are few, if any, subjects which have not received considerable attention. The main requirement in a strategy, therefore, is not to suggest new topics for investigation, but to provide a rational basis for an attack on those already in view.



This conclusion may be illustrated by reference to behaviour and health. At several points in our report attention has been drawn to the importance of behaviour, and it has been suggested that it is now probably the chief determinant of health in many countries. Clearly it deserves high priority among approaches promoted by WHO. But if this is interpreted in the sense that any inquiry which falls under the large heading of behaviour and health should be included, it will lead to support of investigations, many of which will continue into the twenty-first century and beyond, and some of which will make little or no contribution to the aims for the year 2000. The best way to ensure the relevance of research to the defined goal is to focus it on behavioural problems which arise in countries as they pursue specific objectives, such as the improvement of diets, the use of clean water, the elimination of smoking. It is the aim of the classification proposed in our paper to identify these objectives as clearly as possible.

### Tropical diseases

Among the specific objectives, tropical diseases will be considered first, because WHO has already taken to them the approach which we suggest could profitably be followed in relation to other classes. Tropical diseases are identified by certain characteristics: their geographical distribution; their importance as causes of sickness and death; their relative neglect, at least in the recent past; and their intractability - their failure to respond adequately to general improvements in conditions of life. These features have been thought to need a programme of goal-oriented research, and they have largely determined its aims: "To develop new methods of prevention, diagnosis, treatment and vector control specifically suited to selected tropical diseases and to the countries most affected by them". The approach has also led to recognition of the types of investigation required for both technological developments - new drugs, vector control agents and vaccines - and improved operational strategies and programmes of disease control, based on studies of the epidemiology of the diseases, operational research and evaluation of social and economic factors relevant to disease control. Finally, the coordinated attack on tropical diseases has exposed existing deficiencies in research resources (staff and facilities) in the countries most seriously affected.

### Diseases of poverty

Here again we are dealing with diseases which have certain characteristics in common, notably the fact that they are due essentially to

deficiencies and hazards and are rooted in poverty. Their reduction would go a long way towards a major goal for the year 2000, achievement of a minimum standard of health in countries where the need is greatest. The basic measures required are well known, so that the research is essentially of the health systems type.

### Diseases of affluence

For want of a better term we have attributed to affluence those diseases which have resulted from the profound changes in environment and behaviour associated with industrialization during the last few centuries. They appear to include the noncommunicable diseases which are now the common causes of death in developed countries. They fall broadly into the two types mentioned in our conclusions: those in which the major influences are already known (smoking, diet, alcohol, and the like); and those in which the influences have still to be identified.

The volume of research on such problems has greatly increased in recent years, and the question can reasonably be asked whether WHO can do more than encourage the work that is already in progress. Nevertheless, there are additional lines of inquiry which would benefit from a coordinated attack. One of the most important is to observe disease experience of the few populations which have retained traditional ways of life, and to record changes in disease patterns as conditions of life change. For all its difficulties, this approach is particularly needed in relation to abnormalities where the role of environmental and behavioural influences is still relatively obscure. For example, it is regrettable that although we have the impressions of some experienced physicians, we still know little about the frequency of Alzheimer's disease in developing countries. And lacking that knowledge we cannot assess the reasons for the alarming increase in its frequency in the developed world.

### Treatment

Because of the emphasis on prevention it has been essential to leave no doubt about our recognition of the continuing importance of the treatment and care of the sick. From the perspective of the late twentieth century its role is seen to be somewhat different from that envisaged fifty or even twenty-five years ago. It is not, and never could have been, the main determinant of health. But no one aware of the burden of congenital disease, of the multiple restrictions on preventive measures, of the formidable problems associated with aging, can be in any doubt about the lasting significance of patient



care. Its prospects are greatly enhanced by recent advances in biomedical research, whose impact on health care is surveyed in Annex 3. While WHO cannot make a large contribution to the enormous volume of research in progress, its influence continues to be very important, particularly by ensuring that new knowledge which becomes available is widely known and quickly applied.

### Health systems research

It hardly needs to be said that the order in which the major themes have been discussed in the conclusions of our report is in no sense a reflection on their importance. Health systems research has perhaps been somewhat narrowly identified with the delivery of services, but its contribution is across the whole range of applied problems. Our analysis suggests that the success of "health for all", particularly the achievement of a minimum standard of health, depends largely on the solution of problems of the health systems type. But the range of possible problems is so wide in this field that it is particularly important that research should be goal-oriented. This point has been emphasized in recent reports prepared for WHO on health systems research.

### OPERATIONS

Our report presented to the ACMR a year ago took insufficient account of the wide variation in health conditions and resources in different parts of the world. We have therefore regarded flexibility as essential in the proposals now submitted. In practice this means that while general guidelines can be suggested in a global strategy, on many points the final decisions must be taken in Regions and countries according to existing conditions.

To illustrate this point: in the light of the commitment to health for all it seems right that a global report should give the highest priority to the health problems of countries where the need is greatest. Investigations of infant mortality where it is above 100 would, in general, take precedence over those where it is below 10. But for a mother, the death of her newborn child from spina bifida is as tragic as its death from diarrhoea, and in countries where congenital malformations account for a substantial proportion of infant deaths, it seems right that they should receive attention. We have referred briefly to some of the main circumstances which determine the variation in health problems between countries and Regions.

We have also recognized the need to accommodate a global strategy within the WHO framework that already exists. The existing divisions are the result of much thought and long experience, and we have no doubt that they could well look after the developments which would arise from our proposals.

Finally, our exploration of a research strategy should not be allowed to obscure one of the most significant observations about the global health scene: the fact that a great deal of the knowledge required for rapid improvement in health is already available. If this conclusion was questionable in the recent past, it has been put beyond doubt by the progress made in a number of countries such as China, Taiwan and India, in the state of Kerala. These countries differ widely in political, cultural and economic traditions; yet presumably they have all found solutions to basic problems related to food, water, hygiene, population growth and immunization. One of the main conclusions which follows from our report is that we should profit from their experience. It would almost certainly show that with due regard for the large contribution to be expected from the health sciences, what is needed for achievement of an acceptable minimum standard of health throughout the world is not so much new basic knowledge as effective managerial procedures and, above all, political will.



## INTRODUCTION

### The aims of WHO

This report is written against the background of what may be termed the long- and short-term aims of WHO. Since its foundation, WHO has recognized that health is more than the absence of disease, a state of complete physical and mental well-being which results when disease-free people live in harmony with their environment and with one another. This concept keeps before governments and the public the understanding that health is not something that can be achieved exclusively by the traditional health services; it is profoundly influenced by conditions of life. The value of this interpretation is in no way diminished by recognition that it defines a long-term objective, one which largely depends on advances not within the control of health administrations: elimination of poverty; universal education; full and rewarding employment; and, perhaps most important of all, avoidance of war in all its forms.

The short-term aim was identified at the Thirtieth World Health Assembly as "the attainment by all the citizens of the world by the year 2000 of a level of health that will permit them to lead a socially and economically productive life". This concept (Health for All by the Year 2000) has been described in numerous publications and is summarized in Annex 1. Here it will suffice to say that it is concerned not only with improved standards of health, but with equity and social justice, particularly universal access to effective health services.

Improvement in health is of course central to the health for all concept, and it is on this aspect that this report is focused. As present health levels vary widely between countries, no single standard can be set for the year 2000, and the goal is necessarily stated in general terms: to achieve a substantial improvement in health in all countries, particularly in those where the need is greatest. However, it is not unrealistic to define more precisely a level of health below which it is hoped that no country will fall: infant mortality of 50 (per 1000 live births) and life expectation at birth of 60 years. These are levels reached in the mid-twentieth century in developed countries and, more recently, in some developing countries.

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The aim to raise health generally to some of the best levels of the post-war period is not a modest one. Indeed it is an undertaking to achieve in developing countries within two decades advances which occurred in developed areas over as many centuries.

### The scope of the report

This report is concerned with research needed for the prevention of disease, the care of the sick and the delivery of health services. A research strategy is approached by considering four questions.

- (1) How does disease arise?
- (2) In the light of knowledge of its origins, how can disease be prevented, or where this is not possible, managed in other ways?
- (3) What kinds of research are needed for prevention or management of disease?
- (4) What should be the role of WHO within the total research framework?

It will be evident from this approach that the subcommittee is concerned with strategy at the highest level, with assessment of what needs to be done rather than the means by which it can be done. But it recognizes that if accepted the conclusions need to be developed at what may be called tactical and operational levels. To illustrate: the report concludes that tropical diseases deserve high priority and should be tackled with all the resources - laboratory, clinical, epidemiological and socioeconomic - that can be brought to bear on them. At the tactical level it becomes necessary to decide which diseases should be studied in a particular region or country, and by what methods - decisions for experts on tropical diseases; and at the operational level effective arrangements for the promotion of this work at headquarters and in the regions must be considered. The tactical and operational arrangements are obviously very important, and they are not discussed at length only because it seems advisable first to seek agreement on the strategic issues.

The report presents evidence for regarding disease, with some well-defined exceptions, as potentially preventable by modification of ways of life. In this context "ways of life" is a synonym for its two components, environment and behaviour, and the report considers their influence in each



of the major disease classes. As the environment and behaviour play a critical role in disease prevention, the subcommittee underlines the need for intensive study of them.

Discussions of health problems sometimes give the impression that they are concerned particularly with physical health, for which indices such as infant mortality, life expectation and death rates are readily available. At the outset, therefore, we should emphasize the large and increasing importance of mental illness. In developed countries, during the last few centuries there has been no transformation in mental health comparable to that in physical health; nor is knowledge so far advanced, and it could not be said of the one, as of the other, that the full application of what is known would greatly reduce the size of the problems. Indeed the size of some of the problems is increasing. For example, longer expectation of life has resulted in survival to late ages where certain psychiatric illnesses are common; it has also increased the number of mentally disabled and handicapped people, many of whom formerly would have died in early life. Directly or indirectly, changes associated with industrialization and affluence have created psychiatric problems from drug abuse, suicide, promiscuity and the like. Even developing countries have not escaped, and the consequences of changing conditions of life on mental health are to be seen in (for example) the alienation of the unfortunate people displaced from their rural homelands to slums at the periphery of large towns. The importance of increased understanding of psychiatric problems for health and welfare can hardly be exaggerated, and throughout this report the references to prevention of disease, treatment of the sick and delivery of services should be understood to include both mental and physical illnesses.

Finally, we should consider whether the emphasis on disease prevention, care of the sick and delivery of services is consistent with the concept of health to which WHO is committed. Certainly the elimination of disease would not of itself guarantee the happiness which would result from the state of complete physical and mental well-being equated with health in WHO's long-term objective. However, the prevention of disease would remove an enormous source of unhappiness. Indeed the greatest contribution that has been made, perhaps could be made, to human welfare - the fact that in a developed country a mother now knows that the loss of one of her children before maturity is an unlikely event - is a direct consequence of the decline of mortality from infectious diseases, brought about almost entirely by preventive measures.

## DETERMINANTS OF HEALTH

A fundamental issue confronting research on health is evaluation of two approaches to the problems of disease, one through control of disease origins, the other through intervention in disease mechanisms. And as both are needed, what is wanted is a decision about the distribution of effort between them and, so far as possible, recognition of the kinds of problems with which each is likely to be successful. For this purpose we require a classification of diseases, not on the usual physiological or pathological lines, but according to disease origins. Such a classification is needed to provide insight into the means and feasibility of disease control.

The clearest distinction that can be made is between diseases determined irreversibly at fertilization and those - the large majority - not so determined and manifested only in an appropriate environment. Although genetic constitution is important in relation to the latter, such diseases are potentially preventable by control of the environmental\* component. The diseases determined at fertilization cannot be prevented in this way and must be dealt with by other means - contraception, abortion, treatment, modification of genes or chromosomes - measures which are based on knowledge of disease mechanisms. As a basis for a strategy of preventive and therapeutic measures, however, and having regard for the predominant influences on man's health at different periods of his existence, a fourfold classification is more instructive, dividing diseases established before birth into two classes, according to whether they are determined at fertilization or later during intra-uterine life, and dividing conditions determined after birth according to whether they are due to "deficiencies and hazards" or to "maladaptation".

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\* The word "environmental" is used here in reference to all influences other than genes. Elsewhere in the report it is used in a more restricted sense, to distinguish influences determined by public action or neglect from behavioural influences determined by personal behaviour.



## Classification of diseases according to their origins

### 1. Prenatal diseases determined at fertilization

The conditions determined at fertilization are mainly the single gene defects and chromosomal aberrations, but they include others, particularly associated with aging, which are also independent of environmental and behavioural influences. It is unlikely that they include any of the so-called "common diseases". Many of these abnormalities, attributable to printing errors, can be thought of as the price to be paid for the advantages which accrue from the intricate exchange of genes at fertilization.

### 2. Prenatal diseases determined after fertilization

These diseases are not established irreversibly at fertilization and must be determined by other influences during intra-uterine life. They fall broadly into two groups.

Some of the abnormalities arise very early in pregnancy and are probably the result of hazards associated with implantation and early embryonic development. They include (for example) some congenital malformations and certain types of mental subnormality. In such cases the nature of the hazards is unknown and they may prove very difficult to identify and control.

The other abnormalities which arise during intra-uterine life are quite different, in that they result from well recognized causes. Among malformations they include those caused by rubella and thalidomide; and the variation in the incidence of anencephalus (by place of birth, season, social class, birth order) strongly suggests that it may be preventable, although the adverse influences have not yet been identified. Certain diseases of children are attributable to iodine deficiency during pregnancy - cretinism, deaf mutism, spastic gait and feeble-mindedness; others are caused by radiation and, possibly, tobacco and drugs. But probably the most important, certainly the most common of the conditions determined before birth, is "low birth weight". As currently used this term does not refer to an entity, since it includes at least three different types of problems: very early births, many of which are abnormal and would formerly have been classified as abortions; births with small or moderate weight reductions from physiological causes (such as multiple pregnancies); and births of low weight due to maternal causes such as ill-health, malnutrition, smoking, alcohol, and drugs. It is this last class which offers scope for prevention by environmental and behavioural changes.

3. Postnatal diseases due to deficiencies and hazards (diseases of poverty)

As a background to an analysis of postnatal influences it is useful to have in mind the determinants of health of other animals. When domesticated, living in zoos or exposed to hazards of the man-made environment (such as atmospheric pollution) they may be affected by neoplastic, cardiovascular and other diseases. For animals living in their natural habitats under conditions analagous to those of prehistoric man, the evidence, particularly quantitative evidence, is seriously deficient. So far as it goes it suggests that noncommunicable disease is uncommon, particularly in primates. From their extensive study of the pathology of Rhesus monkeys, Lapin & Yakovleva concluded that "the diseases that are most common in man, i.e. malignant neoplasms, rheumatism, cardiovascular diseases, they either occurred seldom or not at all in monkeys".<sup>1</sup> Fiennes noted that before 1972 "only some 200 spontaneous tumours had been described in the literature, in spite of the large numbers of monkeys and apes that have been kept in zoos and research establishments".<sup>2</sup> Hypertension, dental caries and atherosclerotic changes (not affecting the cerebral or cardiac vessels) are sometimes seen in monkeys used in experiments and kept in regular cages over long periods; they are rarely seen in animals kept in open-air cages and "there is no direct reference in the literature to the possibility of atherosclerosis developing in monkeys in their natural habitat". Lapin & Yakovleva concluded that "coronary insufficiency is rightly considered a disease seen only in man".

The main causes of death of other animals discussed by population biologists are food shortage, predation, parasites and disease, taking parasites to include viruses, bacteria, protozoans, helminths and arthropods. In this interpretation the distinction between predators and parasites is based on the fact that predators kill by intention and feed on the dead host, whereas parasites feed on the living host and kill only inadvertently. Hence Christopher Andrewes' comment that "the death of the host is a result as harmful to the virus's future as to that of the host itself".<sup>3</sup>

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<sup>1</sup> Lapin, B. A. & Yakovleva, L. A. Comparative pathology in monkeys. Springfield: Thomas, 1963.

<sup>2</sup> Fiennes, R. Infectious cancers of animals and man. London: Academic Press, 1982.

<sup>3</sup> Andrewes, C. Viruses and evolution. University of Birmingham: The Huxley Lecture, 1965-6.



As the disease referred to by population biologists is mainly that caused by parasites, the four common causes of death are really three. And as both parasites and predators are living things in search of food, they too can be regarded as a single cause. That is to say, the sickness and death of other animals in their natural habitats are due mainly to food deficiency, acting directly through starvation and malnutrition, or indirectly through hazards from other living things seeking food.

It is not a large step from these conclusions to recognition that the same influences were probably predominant on human health during man's evolution, and are still predominant in developing countries in the present day. However, a distinction must be made between their modes of operation before and after the first agricultural revolution initiated by the domestication of plants and animals 10 000 years ago.

For almost the whole of his existence man lived as a hunter-gatherer, well adapted to his environment through natural selection, suffering mainly from direct or indirect effects of food deficiency which could not be countered by genetic adaptation. The causes of ill health were distinguished from those of the agricultural period that followed, chiefly by a different experience of infectious disease. In an illuminating discussion of the effects of changing social organization on the infectious diseases of man, Fenner wrote: "In contrast to other types of disease (genetic, traumatic, neoplastic), the infectious diseases are dependent upon contact, either directly or indirectly through fomites, between individuals of the same species or, in the zoonoses, individuals of different species. For this reason social organization, particularly community size and the degree of frequency of contact between individuals of the same and different communities, has played a significant part in determining the nature and prevalence of the infectious diseases of man".<sup>1</sup> As early man lived in small bands with infrequent contact with other closed bands, numbers were not large enough to maintain directly transmitted microparasitic diseases; but living mainly in tropical areas he was plagued by debilitating infections caused by parasites that complete their life cycles by passing from one human host to another via one or more inter-mediate species. (The statement that some of the few surviving hunter-gatherers

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<sup>1</sup> Fenner, F. The effects of changing social organisation on the infectious diseases of man. In: Boyden, S. W. ed. The impact of civilization on the biology of man. Toronto: University of Toronto Press, 1970: pp. 48-68.

appear to be healthy is based mainly on the observation that they do not have diseases such as hypertension, diabetes, obesity and heart disease. Of course they do not, as these conditions have become common only since industrialization.) Nevertheless, the infections were less conspicuous as causes of sickness and death than in the historical period.

There have been two major changes from the conditions of life of early man, and both had profound effects on health and population growth. One was associated with the first agricultural revolution 10 000 years ago and the other with the agricultural and industrial developments of the last three centuries.

The increase of food supplies that resulted from the first agricultural revolution led to a decline of mortality and growth of population to the size needed to maintain directly transmitted infections; a large, closely knit society living in poor hygienic conditions facilitated the spread of faecal oral and respiratory organisms. As fertility was uncontrolled, populations expanded to the size at which food resources again became marginal. Hence the causes of sickness and death resembled those of the earlier hunter-gatherer period in that food deficiency was still critical, but differed in that its effects were manifested largely through response to infectious disease. In these circumstances an increase in food supplies became a necessary condition for a substantial reduction of mortality from infectious diseases, and limitation of numbers would have to coincide or follow if the reduction was to be maintained.

These, with hygienic measures, were the critical advances made in the last three centuries. The increase in food resulted from advances in agriculture that spread through the Western world from about the end of the seventeenth century. Improvements in hygiene were initiated in the second half of the nineteenth century by sanitary reformers, and greatly extended by the understanding of the nature of infection provided by medical science. Limitation of numbers followed the decline of the birth rate, which fortunately began in the same period (indeed in the same decade in England and Wales), as the hygienic measures. It is one of the remarkable coincidences of history that the indispensable control of numbers appeared at precisely the time needed to ensure that the most important advances ever made in human health were not lost.



As a result of these advances, diseases due to deficiencies and hazards are no longer the principal cause of sickness and death in developed countries. In much of the world, however, the picture remains essentially unchanged or has deteriorated. The World Health Organization recently reported that in the 31 least developed countries life expectation at birth is 45 years and infant mortality 160 per 1000 live-born children; only 31% of the populations have a safe-water supply, and the adult literacy rate is 28%. Infectious disease is still the predominant cause of death, and malnutrition, defective hygiene, and excessive growth of populations are the major influences.

4. Postnatal diseases due to maladaptation (diseases of affluence)

Conditions of life during the last few thousand years, and particularly during the last few hundred, have changed profoundly from those under which man evolved. Present estimates suggest that tool-making animals have existed for a few million years, creatures physically similar to modern man for about 300 000 years and the human subspecies for 45 000 years. On this time-scale the intervals in which the major changes in conditions of life have occurred are very small: 10 000 years since the end of the hunter-gatherer period and the beginning of agriculture; 5000 years since the establishment of large communities; and 300 years since the onset of industrialization. In these short intervals there has not been time for genetic adaptation, so that modern man is exposed to the hazards of industrial life with the genetic equipment of a hunter-gatherer.

The conclusion that the disease pattern now predominant in developed countries is due essentially to recent changes in conditions of life is based on several lines of evidence. They will be summarized for the two commonest causes of death in developed countries, cardiovascular disease and cancer.

(a) Twin evidence. Concordance rates are relatively low and not much higher for monozygotic than for dizygotic twins. That is to say, the frequency with which two children of the same family are both affected is not much greater if they are genetically identical than if they are not.

(b) Secular trends. The incidence of some of the diseases has changed in genetically stable populations. For example, death rates from breast cancer have recently increased in Iceland, rates from gastric cancer have decreased

in North America and there has been a remarkable reduction of deaths from coronary heart disease in several countries.

(c) Change of environment. A racial group which has changed its environment and associated ways of life (for example, Japanese living in the United States of America) exhibits the disease pattern of the population with which it shares its environment rather than of the population with which it shares its genes.

(d) "Western diseases" in developing countries. Evidence of the effects of changes in conditions of life have been brought together by Trowell & Burkitt.<sup>1</sup> They invited contributors to describe their experience in several countries as Westernization occurred. There are four main lines of evidence. Firstly, until recently many of the noncommunicable diseases now predominant in the West were uncommon or absent in hunter-gatherers and peasant agriculturists. Secondly, when these populations change from their traditional ways of life to those of developed countries they begin to exhibit the Western pattern of disease. Thirdly, the incidence of some of the diseases has declined in Western populations which have reversed certain features of their life-style to bring it closer to that of peasant agriculturists. And finally, the editors conclude that of the multiple influences responsible for the Western pattern of disease, dietary changes are probably the most important.

The evidence assembled, particularly on the first two points, is impressive. Before 1940, in Africans of Kenya and Uganda, blood pressure did not rise with age and essential hypertension was rarely seen; it is now a common disease. Obesity was almost unknown in 1930 when Julian Huxley noted with amazement that almost the only fat woman he saw in Africa was in the Nairobi brewery; the towns of East Africa now contain many fat upper class Africans. In Kenya in the 1930s, diabetes was rare in Africans (but not in Europeans and Indians); today there are large diabetic clinics in all town hospitals. Cerebrovascular disease was the first arterial disease of clinical importance to emerge in Africans; before 1948 a case due to essential hypertension was rarely or never seen; in 1970 it was the commonest cause of

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<sup>1</sup> Trowell, H. C. & Burkitt, D. P., eds. Western diseases: their emergence and prevention. London: Edward Arnold; Cambridge, Harvard University Press, 1981.



death in a large series of neurological patients in a Ugandan hospital. Coronary heart disease is said to be the last major cardiovascular Western disease to appear - the first clinical reports of cases were made quite recently in Uganda (1956) and in Kenya and Tanzania (1968).

The changes in conditions of life that have resulted from recent economic and industrial developments must now be added to deficiencies and hazards as postnatal determinants of sickness and premature death. Some are influences over which the individual has little control: atmospheric pollution; chemicals used in industry, agriculture and as food additives; adverse working conditions; road traffic; exposure to ionizing radiation; risks associated with medical investigation and treatment. However, most of the hazards are due to changes in behaviour, many of which are made possible or encouraged by the affluence which resulted from industrialization: smoking; sedentary living; drug abuse; excessive or ill-balanced diets. Hence some of the contemporary health problems can be resolved by public action, but most require modification of behaviour.

The most important medical advance in the nineteenth century was the discovery that infectious diseases are largely attributable to conditions of life and can often be prevented by control of the influences which lead to them; the most significant advance in the twentieth century is the recognition that many noncommunicable diseases are also due to lifestyle and are potentially preventable.

#### Problems of nomenclature and classification

In the preceding discussion postnatally-determined diseases have been attributed to "deficiencies and hazards" and to "maladaptation". The first term seems reasonably satisfactory in reference to the causes of sickness and death common during most of man's existence; the second is less satisfactory in relation to the diseases which have recently become predominant in developed countries. It is true that many, probably most, of these diseases have resulted from changes - in diet, exercise, smoking, reproduction and the like - which have led to maladaptation, changes to which human genes could conceivably adapt over a long period if natural selection were to operate unchecked by medical and other interventions. But the contemporary pattern of ill health in developed countries is also attributable to environmental hazards such as road accidents, atmospheric pollution and warfare, which have much in common with the hazards of the prehistoric period (hunting accidents, tribal wars, infanticide) and cannot be said to be due to maladaptation.

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Nevertheless the recent profound change in disease pattern is a unique phenomenon in human experience and it is clearly desirable to decide what the "new" diseases are to be called. They have been referred to as diseases of civilization, diseases of affluence, diseases associated with industrialization and Western diseases; and there is something to be said for and against the use of each of these terms. For the present purpose they will be called diseases of affluence, in contrast to those attributed to deficiencies and hazards which will be referred to as diseases of poverty. The terms are not entirely satisfactory - impoverished populations are exposed to some of the risks of affluence (tobacco, alcohol, drugs) - but they are probably less objectionable than the alternatives.

Can all diseases be assigned to one of the four classes? It is possible to think of some which would be difficult to classify, particularly in the field of mental illness. (Forexample, a suicide or manic depressive illness in a hunter-gatherer.) However, the difficulty arises mainly from lack of knowledge of etiology rather than from the limits of the classification. There is no ambiguity in the statement that: (a) diseases are determined at fertilization or they are not; (b) environmental and behavioural influences operate before or after birth; and (c) postnatal influences are divisible into those which expose a population to hazards to which it is not genetically adapted and those (referred to as deficiencies and hazards) which affect a population in spite of genetic adaptation.

#### Inheritance, environment and disease

In suggesting that diseases not determined irreversibly at fertilization can in principle be prevented by control of environmental influences, are we overlooking the importance of genetic constitution (i.e. non-genetic)? In the presence of the environmental component required for the manifestation of a disease, its frequency is largely determined by genetic constitution. Nevertheless, however prone an individual may be genetically, he is affected only in the appropriate environment. This is as true of non-infectious as of infectious diseases, of lung cancer and cirrhosis of the liver as of tuberculosis and poliomyelitis.



## RESEARCH NEEDED

In the light of the preceding analysis of disease problems, basic requirements for health may be summarized as follows. In developing countries health depends in large part on removal of the long-standing deficiencies and hazards associated with poverty, without incurring the new risks that have appeared under modern conditions, particularly in relation to affluence. In developed countries the chief requirement is to control for health purposes an environment that is largely man's creation, and to modify those features of behaviour for which the genes are ill-adapted.<sup>1</sup> In both developed and developing countries the formidable problems determined prenatally present a continuing challenge to biomedical research. But this is no more than a first approach, and it will be necessary to examine more closely the issues which arise in each of the disease classes. We must also consider carefully the extensive research needed in the treatment and care of the sick and the delivery of health services (health systems research).

### Prenatal diseases determined at fertilization

The relatively intractable character of most conditions determined at fertilization, indeed of most conditions determined before birth, is evident from the fact that in developed countries they have not responded to the influences which have been so successful with postnatal diseases. A considerable proportion of spontaneous abortions are known to be malformed and, so far as can be judged, over the period in which there has been a large reduction of postnatal mortality, there has been little change in the frequency of prenatal deaths (Fig. 1).

However, this is not to say that they offer no scope for prevention and treatment. The prevention of rhesus haemolytic disease is a remarkable example of an advance made possible by a combination of genetic and clinical

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<sup>1</sup> These distinctions between developed and developing countries are becoming blurred because the diseases associated with modernization are increasingly taking hold in the developing world. Moreover some diseases (for example some forms of mental illness) appear to be as common in developing as in developed countries.

knowledge. The identification and abortion of a fetus affected by Down's disease is another solution of an apparently intractable problem. Equally impressive in a quite different way is the immense technical accomplishment which restores a child with a patent ductus arteriosus or atrial septal defect to a life of normal duration and quality.

For medical research the significant conclusion is that the diseases in this class are unlikely to be prevented by control of environmental and behavioural influences, and they must be tackled by other means which depend on knowledge of their mechanisms. This indeed is the field which uniquely requires the traditional laboratory and clinical approaches, and the more successful other measures are in dealing with preventable conditions, the more important the residual prenatal problems will be seen to be. They have recently been reviewed.<sup>1</sup> By their nature these problems are most suitable for well-equipped research centres which are mainly to be found in developed countries.

#### Prenatal diseases determined after fertilization

It seems unlikely in the immediate future that most of the abnormalities established very early in intra-uterine life can be prevented by environmental and behavioural changes, and like those determined at fertilization they must be tackled by other means - contraception, abortion and treatment - based on knowledge of disease mechanisms.

The diseases due to well-recognized hazards - iodine deficiency, smoking, radiation, infection and the like - clearly provide scope for preventive measures. The large problem of low birth weight is, probably necessarily, approached from two different directions. In specialized centres of developed countries improved clinical care is leading to the survival of a considerable proportion of low birth weight infants. Even more important, however, is improvement in maternal health before and during pregnancy, in order to reduce the frequency of low birth weight, particularly in developing countries. In the same context we should also refer to the importance of reducing maternal mortality which, in several countries, has not yet fallen to an acceptable level.

The prenatal diseases determined after fertilization require research which falls under the same headings as diseases which arise after birth.

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<sup>1</sup> Weatherall, D. J. The new genetics and clinical practice. The Nuffield Provincial Hospitals Trust, 1982.



The abnormalities associated with implantation and early embryonic development are probably best tackled by investigation of their mechanisms through biomedical research. Maternal ill health from malnutrition and related causes is associated with poverty; the measures needed are well known and the research required is of the health systems type. Abnormalities attributable to alcohol, tobacco, drug abuse and other health-damaging behaviour are comparable to post-natal diseases of affluence, and the research is again of the applied type and largely behavioural. Reduction of infant and maternal mortality requires improved health care before, during and after labour. Most of these problems have their analogues in post-natal life, but they are given special poignancy because of their impact on the child as well as on the mother.

At this point we should stress the significance of maternal and child health in relation to the goal of health for all. The experience of developed countries (see Fig. 1) leaves no doubt that increased expectation of life in developing countries will come predominantly from the saving of life in infancy and childhood. The mother's health, particularly during and after pregnancy, has a profound effect on the health of her children; and her behaviour has a large influence on the well-being of her family. Indeed, recent experience in countries which have made rapid progress in health suggests that maternal literacy is probably the main requirement for achievement of the critical regulation of family size.

### Diseases of poverty

For insight into the measures needed to prevent these diseases we turn to the experience of developed countries. The transformation of health between the eighteenth and twentieth centuries was due essentially to the decline of infectious diseases, brought about mainly - until 1900 wholly - by better nutrition, provision of clean food and water and improvements in hygiene. In the twentieth century infectious deaths were reduced further by immunization and therapy. It is probably true to say that if these basic measures were implemented throughout the world one of the most important aims of health for all - an acceptable minimal standard of health - would be achieved even if nothing else were done; if they are not implemented this aim will not be achieved whatever else is done.

For the success of these measures we must stress the significance of population control. In developed countries, if the advances in food and hygiene in the nineteenth and twentieth centuries had not been accompanied by declining birth rates they would rapidly have been offset by rising numbers. In developing countries today, a proper balance between numbers and resources is essential for improvement in health. Annex 5 gives a brief account of the broad range of WHO's activities in the field of population and health. It is concerned not only with the biological and social problems related to the regulation of fertility, but also with the quality of life of human populations, particularly in developing countries.

It follows that a primary aim of research should be to bring about the necessary changes in food, water, hygiene and rates of population growth, and to support them by immunization and treatment of some of the common infections. Modification of behaviour is essential for achievement of the changes. All of these measures are included in the concept of primary health care. However, as they cannot be provided solely by health services, it is essential to determine to what extent they depend on other services, so that there is no doubt about where responsibility lies. This research will bring us face to face with the long-standing and still unresolved problem of the relation between poverty and health.

The diseases due to deficiencies and hazards are predominant in developing countries, but it should not be forgotten that there are sub-groups in developed countries which live in or near to poverty and lack some of the basic requirements for health. Research should therefore be concerned with identification of these sub-groups and with the means of eliminating their deficiencies and hazards.

### Diseases of the tropics

As many developing countries are in tropical and sub-tropical areas, their diseases include both infectious and noncommunicable diseases (for example, the hereditary anaemias) which were absent or uncommon in the developed world. Conceptually they belong to the "diseases of poverty", in the sense that they are due to deficiencies and hazards and could be prevented if resources were unlimited (in the extreme case, by removal of populations from hazardous areas). In practice, however, resources are severely restricted, and as the tropical diseases frequently do not respond to simple improvements in conditions of life, the solution must come from new knowledge obtained through laboratory, clinical, epidemiological and socioeconomic research.



## Diseases of affluence

It is only in the last few decades that it has begun to be recognized that the noncommunicable diseases now common in developed countries are not to be regarded as a hard core of genetically determined conditions, previously obscured by the shortness of life and the predominance of the infections. Most of them are due to environmental and behavioural changes associated with industrialization, and an important challenge to medical research is to identify and reverse the influences that are responsible.

The following are among the lines of inquiry that need to be followed:

- (1) Assessment of the frequency of the diseases in developing countries that have retained the traditional ways of life. As conditions are changing rapidly this is a task of some urgency. It will be necessary to seek standardized criteria and methods of diagnosis.
- (2) Examination of the changing patterns of disease as modernization occurs.
- (3) Assessment of the influences responsible for the change in disease pattern.
- (4) Investigation of the feasibility of avoiding the adverse influences.

Elimination of many environmental and behavioural hazards related to affluence would improve the quality as well as the duration of life. Nevertheless there are some changes which would be unacceptable: for example, a lower age of reproduction and an increase in family size should these changes be needed to prevent breast cancer. In such cases another approach - mainly biomedical - must be sought.

Investigation of the possibility that a condition is attributable to ways of life associated with affluence should cover all diseases (other than those due to deficiencies and hazards) which are not clearly determined irreversibly before birth. It should include even such apparently intractable conditions as the pre-senile and senile dementias, examining the possible significance of infective, dietary and other influences. Indeed, whatever we may think of its likelihood, there could be no more dramatic and significant advance in

medicine than the finding that some of the common forms of mental illness, like most of the common forms of physical illness, are due to conditions of life and are potentially preventable.

When considering the impact of ways of life on health we must recognize the importance of influences determined by personal behaviour. They are significant in developing countries, not only in relation to mental illness and basic needs such as nutrition, sanitation and family planning, but also for control of new hazards acquired from the developed world - alcohol, smoking, vehicle use, and the like.<sup>1</sup> In developed countries it has been estimated that as much as 50% of mortality from ten leading causes of death can be related to lifestyle. Among the well-recognized risk factors are cigarette smoking, excessive alcohol consumption, use of illicit drugs, certain dietary habits, insufficient exercise, reckless driving, non-compliance with therapeutic or preventive regimes and maladaptive responses to social pressures. Hamburg and his colleagues have examined these influences in detail, and have outlined a programme of research needed for their understanding and control.<sup>2</sup> Their conclusions are summarized in Annex 2.

### Treatment and care of the sick

In the preceding discussion the emphasis has been on research related to preventable and potentially preventable diseases of developing and developed countries. It would, however, be a serious misrepresentation to suggest that all diseases due to deficiencies and hazards or to maladaptation can be rapidly eliminated and treatment limited to diseases determined before birth. There are many problems which will not be resolved in this way in the foreseeable future, and for whose solution - partial or complete - we must rely on knowledge of disease mechanisms obtained through biomedical research. They include, in addition to conditions determined before birth, diseases which may be preventable but whose prevention may be delayed, in some cases indefinitely, for various reasons: because the harmful influences are unknown or not fully understood (as is the case for essential hypertension, atherosclerosis, some forms of arthritis and many cancers and mental diseases);

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<sup>1</sup> D. A. Hamburg and A. Russell. Linking health and behaviour in developing countries.

<sup>2</sup> D. A. Hamburg, G. R. Elliott and D. L. Parron. Eds: Health and Behaviour.



because they are costly to eliminate (as are many occupational hazards); because their control involves changes in behaviour (as in cancer of the lung, cirrhosis of the liver and traffic accidents); because they are biologically complex (as are malaria and schistosomiasis). For as long as the causal factors are not removed there will be need for treatment of diseases which are potentially preventable. The knowledge on which such treatment is based must come from biomedical and behavioural research.

Many of the conditions referred to in the previous paragraph are responsible for a large and costly burden of chronic illness for which it may be possible to provide relief and comfort but not cure: for example, people who survive an acute illness such as a heart attack or stroke may be left with serious disability, and patients with cancer often need intermittent treatment over many years. There are formidable problems related to the care of the dying patient. In all of these circumstances, thoughtful, painstaking and compassionate care must be provided, and research is required on the control of symptoms (e.g. relief of pain), methods of treatment, and rehabilitation. Such research extends substantially into the behavioural and socio-economic fields.

The knowledge required for treatment and prevention of disease comes largely from biomedical research. Its scope and prospects are discussed in Annex 3.

### Delivery of health services

Research on the delivery of health services has been referred to mainly as health services or health systems research, and various specifications have been given of its range of activities. In the present context, attention will be focused on the implications for health services of the health for all concept. At Alma-Ata it was agreed that primary health care was to be the key to improvement in health. From the Alma-Ata and subsequent thinking, five sets of ideas or guidelines can be outlined (see Annex 1).

- Health services should be effective, efficient, affordable, and culturally acceptable.
- Efforts to deal with health should include disease prevention, health promotion, and curative and rehabilitative services.
- There should be universal coverage.

- Individuals and communities should participate in health activities in ways that promote self-reliance and reduce dependencies.
- Health activities should be integral to community and national development.

These guidelines flow mainly from the spirit of health for all and are not intended as a research agenda. Nonetheless, it is probably true to say that if any of them were ignored progress would be substantially diminished.

In the light of these considerations, some general statements can be made about the nature and approach of research on the delivery of health services.

The object of the research is to improve health care. This requires that attention be directed to problems that are relevant to community needs, and can be solved.

The problems selected for research must be close to the needs of communities and the concerns of policy and decision-makers, and research results must be understandable in their terms and in keeping with their timetables in order to ensure or at least facilitate its utilization.

In considering priorities, attention is directed to policy and programme areas where research on the delivery of health services will have an important supportive role to play. Three areas will illustrate the range of problems.

- Policy analysis is necessary for research on health services: how policies are made, the information on which they are based, how they are translated into action, and how they will be evaluated. An important corollary is how research can support health policy making.
- The managerial process for national health development is critical for planning. Research on health services can investigate questions that emerge in that process and test principles and procedures that flow from managerial decisions. The main emphasis of research on health services is to improve existing services fundamentally, and the managerial process is one of the main channels for doing so.



- Although it is agreed that there must be greater equity in the provision of health services, there is doubt about its exact meaning. Universal coverage that takes differential needs into account appears to be intended; but methods of defining such needs and the programmatic responses that should follow are not well developed. The methodological problems involved in dealing with measurements of coverage, effectiveness, and efficiency are major challenges for research on the delivery of health services.

Generally, health systems research is applied research. While it will be necessary from time to time to develop new methods of dealing with new problems, and research will be needed to study culturally-specific problems, the usual requirement will be to use known methods to investigate current problems.

Research on the delivery of health services must be given adequate support, and so organized that diverse disciplines and sectors are brought together into effective working teams, and research groups effectively linked with communities on the one hand and policy-makers on the other.

Present capacity for research in this field, at both individual and institutional levels is seriously limited, and it is essential to build local capabilities with support from national and international sources (see Annex 4).

## THE RESEARCH STRATEGY OF WHO

### The past and the future

"If we could know whence we have come and whither we are going we would know better what to do and how to do it."<sup>1</sup> In the health field there is no longer much doubt about whence we have come. The long debate of the eighteenth and nineteenth centuries concerning the origins and control of infectious diseases is at an end. We now know that the decline of the infections, and the vast improvement in health to which it led, resulted from advances in conditions of life, strongly supported in the twentieth century by immunization. In respect of one important aspect of whither we are going there is not much room for dispute. Except for diseases specific to the tropics, the infectious diseases of developing countries can be largely prevented by well-known means, covered by the broad concepts of primary health care and other aspects of community development.

There is not the same agreement about noncommunicable diseases, and the arguments about how to deal with them are reminiscent of the debate on the infections in the nineteenth century. In this paper we have presented evidence which underlines the effectiveness of the preventive approach: the observation that noncommunicable diseases are uncommon in wild animals - particularly primates - in their natural habitats where they are not in contact with the man-made environment; and the several lines of evidence (pages 29-31) which suggest that most of these diseases in man are potentially preventable.

If this interpretation is correct it is possible to speculate with reasonable confidence on whither we are going. In, let us say, 50 years time, if economic conditions continue to improve and a major man-made catastrophe such as nuclear war has been avoided, the main advances will have been: (a) a vast improvement in health in developing countries, brought about by the decline of diseases (mainly the infections) due to deficiencies and hazards, and diseases (infectious and noncommunicable) specific to the tropics; (b) a large reduction in the frequency of diseases associated with affluence, of which a beginning is already evident in the fall of mortality from cardiovascular disease and some forms of cancer; and (c) substantial progress in the treatment of

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<sup>1</sup> A. Lincoln, The "House-Divided" Speech.



established disease. It is not a reflection on the importance of treatment to conclude that the first two advances will have a much greater impact on health than the third.

It is against this background that we should assess the research strategy of WHO. Before doing so, however, we must consider ways in which the responsibilities of WHO differ from those of other research organizations.

### The role of WHO

The role of WHO in research is distinguished in at least two respects from that of an institution such as a medical school, research foundation or a national research council; it has a wider vision and a larger responsibility. From experience of the enormously varied conditions which exist in different parts of the world it sees health problems from historical and international perspectives in a way that is hardly possible for those who have not shared the experience. As a result it should be able to assess the determinants of health, and to arrive at a just balance between preventive and therapeutic measures, between basic and applied research and between the needs of developed and developing countries. From this knowledge it should be in a position to determine the most direct and economical means to achieve the goals which have been set for it.

WHO's role is also distinguished by the fact that it has a responsibility in relation to the health of all countries. In practice this means that whereas other research institutions can devote their attention largely to long-term projects, WHO must promote research which will raise the health of all people to an acceptable level as rapidly as possible. It should also strive to improve the quality of research so that certain minimum standards are maintained throughout the world.

In view of these responsibilities it is suggested that the research strategy of WHO should differ from that of other organizations, and indeed from a strategy which would be appropriate for medical research as a whole. From medical research as a whole support is needed for all the main lines of attack on health problems. The role of WHO within the larger framework should be determined in the light of two considerations: the need to make rapid progress, particularly in countries where health is poor; and the fact that the resources of medical research throughout the world are mainly invested in the therapeutic approach.

## Research strategy

The role proposed for WHO is in the following areas:

### 1. Diseases of poverty

The first priority should be to encourage and assist research which will raise the standard of health in developing countries and in certain deprived sub-groups of developed countries. The steps needed are well known - provision of safe and balanced food, clean water, sanitary facilities, population regulation, immunization and treatment of some of the common infections - and the research required is essentially of the health systems type. The effectiveness of these measures is already evident from the rapid progress recently made in some developing countries. Both behavioural and environmental influences are important, and individuals and communities need to take active parts in the development and implementation of the required services to ensure their relevance and effectiveness.

### 2. Diseases of the tropics

Improvement of health in developing countries also requires advance in knowledge of diseases characteristic of the tropics. They differ from the conditions referred to under 1 in that they do not respond adequately to a rising standard of living, and basic knowledge required for their control is still lacking. They therefore need to be tackled with all the research resources that can be brought to bear on their prevention and treatment.

### 3. Diseases of affluence

Second only to the primary aim (discussed under 1 and 2) should be promotion of research on the noncommunicable diseases, predominant in developed countries and now threatening to advance in developing countries which are at risk of having the worst of both worlds. In some, the influences, such as smoking and alcohol, are well known, and the research is largely concerned with behaviour. But in many diseases the hazards have not yet been identified, and the research required is essentially epidemiological, to unravel the disease origins, (for example, in many cardiovascular, endocrine and gastroenteric disorders).



If a reminder were needed that infectious diseases must not be forgotten under conditions of affluence, it is provided by the appearance of AIDS, which shows that viruses with high mutagenicity can be the origin of new epidemics.

#### 4. Treatment and care of the sick

Even if progress in prevention is as rapid as we would like it to be, the treatment and care of the sick will continue to be of the highest importance. On the most optimistic assumptions it will still be necessary to care for patients with disabling and life-threatening illnesses, as well as with the many kinds of morbidity which diminish the quality of life from day to day.

For the knowledge on which treatment and care are based we rely on biomedical research, and WHO should continue to stimulate and support it. From time to time it should commission specific research projects and provide seed money for them. This has been particularly valuable at a time when research on tropical diseases has diminished. WHO should continue to provide support for research trainees from developing countries. Above all, through meetings, workshops, expert committees, the provision of consultants and the exchange of researchers (particularly between developed and developing countries), WHO should ensure that new knowledge is rapidly and widely disseminated and thoughtfully and sensitively applied.

#### 5. Delivery of health services

The need is for health services that address the critical determinants of health. The precepts of health for all carry the further requirement that services cover entire populations, particularly the most vulnerable individuals and groups. The research requirements are formidable: to join with policy-makers and communities in assessing needs, planning, financing and implementing programmes, and evaluating them in terms of coverage, efficiency and effectiveness. Health services, are largely specific to local circumstances - traditions, resources, politics, culture - and it is necessary, therefore, to develop local capacity for this kind of research. The development, organization and support of research on the delivery of health services requires national, regional and international collaboration.

## Regional variation

The research strategy outlined above is written in global terms and without reference to the different circumstances which exist between regions and between countries within the same region. The strategy obviously needs to be adapted to the circumstances of a particular region, and the following are some of the important variables to be considered:

- (1) The nature of the predominant health problems. Countries are divisible broadly into two groups, according to the predominant health problems. But within these groups there is wide variation. For example, tropical diseases occur mainly in developing countries, but there are differences between them in the frequency and character of the infections. In developed countries there is variation in the pattern of most noncommunicable diseases.
- (2) The present level of health. There are large differences in health status between continents, between countries and between different regions and social classes within the same country. A recent examination of inequalities in health revealed gross differences which still exist within a developed country.<sup>1</sup>
- (3) Economic resources. Countries differ from one another in the proportion of the gross national product that they have been willing to assign to health services. In many developing countries the basic resources are insufficient, and it is difficult to make rapid progress without a larger allocation and international cooperation. Moreover, both developed and developing countries frequently fail to make efficient use of the resources that are assigned for health purposes.
- (4) Cultural, religious and political traditions. It is evident that health research, like health policies, needs to be adapted to the traditions of a country or region.
- (5) The organization of health systems, the effectiveness and efficiency of health services and the extent to which they embody the principles of health for all vary greatly from country to country.

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<sup>1</sup> Townsend, P. & Davidson, N. Inequalities in health: The Black Report. Penguin Books: London, 1982.



- (6) Research capacities. A research strategy must recognize the limited research capacities of developing countries and the need to strengthen them.

### The operational approaches of WHO

In this report a classification of diseases according to their origins and means of control has been used to indicate the main lines of a research strategy. Such an approach is essentially conceptual, and may appear to be inconsistent with the operational approaches which WHO necessarily takes. In practice there need be no inconsistency, if it is recognized that the conclusions derived from the concepts need to be fitted into the existing operational framework. Annex 5 gives some examples.

Some approaches are common to the various activities of WHO.

- (1) Strengthening of the scientific and technological infrastructure. One of the main reasons for underdevelopment is the lack of the appropriate infrastructure which exists in industrialized countries. If the research capability of developing countries is to be enhanced, appropriate human and material resources need to be available. Such resources include a wide span of facilities, from workshops and libraries to transport and telecommunications.
- (2) Development of manpower resources. The balance between qualified scientists and other personnel is particularly important. At various levels (laboratory, clinical, field) scientists may become unproductive in the absence of other workers such as mechanics, nurses or social workers. The teamwork approach is needed at all levels, but particularly where contact with the community is indispensable for the promotion of health.
- (3) Community participation. If research is to be undertaken at the first level of contact between people and the health system, the individuals, families and communities concerned need to assume some responsibility and to contribute to their own health development. For example, the community needs to be involved in assessment of the situation, the definition of problems and the setting of priorities; and each individual should realize that he can, by his own behaviour, have a profound impact on his own health.

(4) Intersectoral coordination. All sectors involved in socioeconomic development are interdependent. Education is at the base of development. Agriculture plays an important role in securing self-sufficiency in food. Housing is critical for a healthy environment, including a safe-water supply and efficient waste-disposal system. Public works and communications are essential to the functioning of all services and to effective interactions between people. In relation to the quality and effectiveness of the educational system, the agricultural pricing structure and the distribution of urban and periurban services, many questions remain unanswered. Although these may appear to lie outside the sphere of competence of WHO, their relevance to health is indisputable. Research in all these areas is crucial to health development as there are still many gaps in knowledge.



## CONCLUSIONS

Disease is not an inescapable attribute of the human condition; except when determined at or soon after fertilization, it results essentially from unhealthy ways of life and can be prevented if those ways can be changed.

For almost the whole of his existence man, like other living things, was unable effectively to control his environment or limit his reproduction, and the chief causes of sickness and death were deficiencies of basic resources or hazards arising from competition for them. These are still the predominant causes of disease in developing countries.

In developed countries during the last few centuries it has been possible to exercise a considerable degree of control of the environment - in relation to health, particularly by increasing food supplies and improving hygiene - and, for the first time in human experience, the advances were not lost because of rising numbers. These advances have led to the decline of diseases (chiefly the infections) due to deficiencies and hazards; but, ironically, they have resulted in a new pattern of noncommunicable diseases attributable to profound changes in the environment and in behaviour.

The research strategy of WHO should be devised primarily in the light of the commitment to substantial progress in health by the year 2000, particularly in countries where the need is greatest. Against the background of the preceding analysis the following are the steps which are likely to lead to rapid advance:

- (1) Control of diseases associated with poverty. The research needed is essentially of the health systems type, as the effective measures are well known: provision of sufficient and safe food; clean water; adequate sanitary facilities; fertility regulation; immunization and treatment of common infections. Individuals and communities have important roles to play in relation to their own health behaviour and to ensure implementation of the required measures. The aim of research should be to assist administrations and communities to achieve these advances as directly and quickly as possible.

(2) Control of diseases, both infectious and noncommunicable, specific to the tropics. These diseases do not respond adequately to the relief of poverty and the measures referred to under (1) and they should be attacked with all the resources - laboratory, clinical, epidemiological and socioeconomic - that can be brought to bear on them.

(3) Control of diseases associated with affluence. This requires investigation of the environmental and behavioural influences which have led to the noncommunicable diseases now predominant in developed countries and beginning to appear in the developing world. In some, the major influences (tobacco, alcohol, occupational hazards, etc.) are already known, and the research required is predominantly concerned with behaviour; in others, the influences are unknown and research, particularly epidemiological, is needed into disease origins.

(4) Treatment and care of the sick. Even on the most optimistic assumptions about disease prevention, it will be necessary to make extensive provision for the treatment and care of the sick. For this we must rely mainly on biomedical research (which also, of course, contributes powerfully to the preventive measures). WHO's contribution, although modest financially, will continue to be important. It contributes to the success of biomedical research in many ways, particularly by ensuring that new knowledge which becomes available is widely known and quickly applied.

(5) Delivery of health services. The critical determinants of health should be addressed through health services that are relevant to local needs and cultures and aim to cover entire populations, particularly the most vulnerable groups. To join with policy-makers and communities in assessing needs, planning, financing and implementing programmes and evaluating them in terms of coverage, efficiency and effectiveness is the challenge for WHO in health systems research.

The application of these principles will inevitably differ between regions and between countries within the same region, according to many variables: the nature of the predominant health problems; the present level of health; economic resources; cultural, political and religious traditions. However, the aim should be common to all: to focus research where it will result in rapid advance to the health for all goal of improved health.



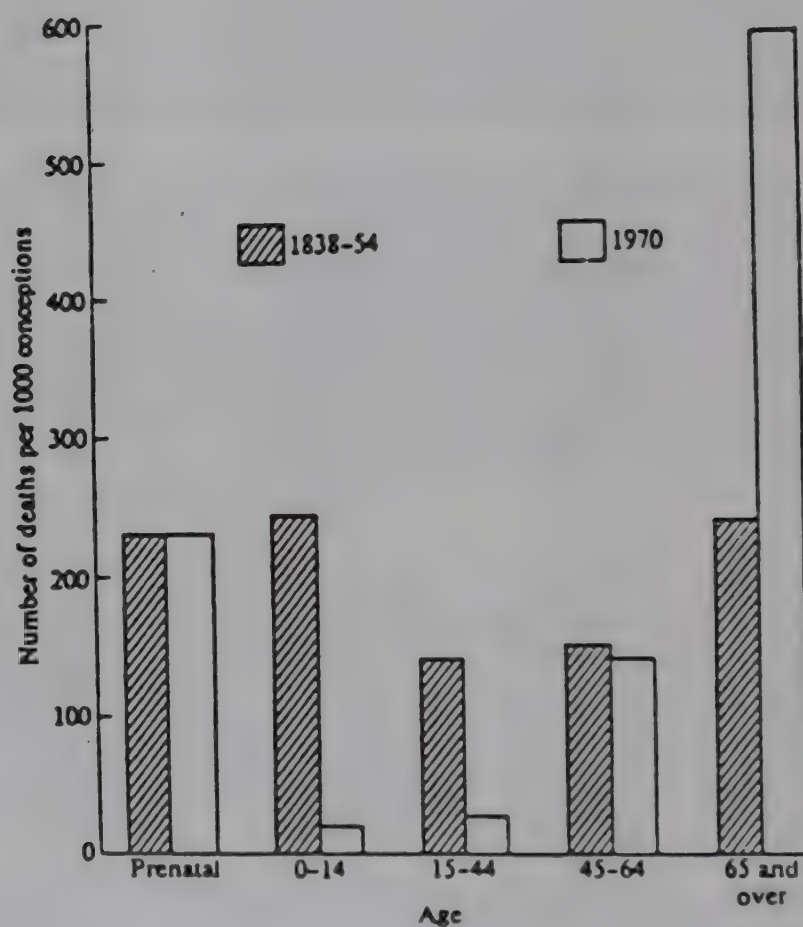
Without neglecting the care of the sick, the strategy places the emphasis on achievement of health through prevention of disease. This approach in the short- and medium-term does not overlook the long-term objectives which WHO has always set for itself, based on recognition of health as a state of complete physical, mental and social well-being. The achievement of these objectives does of course depend on advances in society, many of which are not within the responsibilities of health administrations: particularly elimination of poverty; universal education; full and rewarding employment; and most important of all, avoidance of war in all its forms.

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FIG. 1. MORTALITY AT DIFFERENT AGES: ENGLAND AND WALES<sup>1</sup>



<sup>1</sup> McKeown, T. The Role of medicine: dream, mirage or nemesis? Blackwell, Oxford, 1979.



## WHO'S CONCEPT OF HEALTH FOR ALL

Health for all is more than a challenge to achieve certain standards of health by the turn of the century. It can also be seen as a value system oriented toward social justice, with a special concern for the underprivileged. It is directed toward making it possible for all people to live socially and economically productive lives. There is risk, of course, that, defined too broadly health for all has limited prospect of achievement, but defined too narrowly it risks missing the central meanings on which much of its value and support are based.

With social justice in mind, the conferees at Alma-Ata specified that primary health care was to be the key to the advance. Five sets of ideas cover the essential meanings of Alma-Ata and subsequent thinking.

- Health services should be effective, efficient, affordable, and acceptable. That services be effective with respect to the problems of each society must be at the heart of any effort to conceptualize a research agenda in health. That they also be efficient, affordable and socially acceptable are logical corollaries.
- Efforts to deal with health should include disease prevention, health promotion, and curative and rehabilitative services. These parameters reflect concern for the determinants of health and well-being as well as of disease. Disease prevention must be seen as the cornerstone for the building of health strategies. Health promotion goes beyond disease prevention and calls on individuals, communities and societies to address the ways in which they live their lives and care for their environments. Not all disease can be prevented, and those who are afflicted and disabled require care that will ease suffering, limit progression of disabilities and improve functions.
- There should be universal coverage with health services. Equity in the distribution of health services is demanding in both technical and political terms, and must be addressed in any research strategy related to health for all.

- Individuals and communities should participate in health activities in ways that promote self-reliance and reduce dependencies. The development of health services should involve people in planning, implementing and evaluating health programmes. Health activities become a means for individual and community growth rather than merely services to be provided.
- Health activities should be integral to community and national development. Health should be seen not only as an end in itself but as a component of development more generally. The development process is rooted in the social, cultural and political values of each society; as an integral part of that process health merges with those same values. Thus, health becomes much more than a technical matter, but is close to the values and aspirations associated with the quality of life.

### Aims for the Year 2000

In view of these ideas about the content and meaning of health for all, what can be said about aims for the turn of the century? Answers must be given in both social and technical terms, because both emphases are necessary. Since health for all is oriented toward social justice and equity, an important aspect of the goal is that nations will make concrete policy and programmatic commitments to the basic premises. In this sense, the commitment is to the permanent pursuit of universal coverage with effective services, in which both the coverage and effectiveness issues are subject to continuous re-examination in the light of shifting needs and response capacities.

In more technical terms, targets must be determined in light of the circumstances and priorities of each country. Some countries have already exceeded thresholds of health that others have only the slimmest hopes of reaching by the turn of the century. Thus, each country should establish its own targets. In general, those targets could be related to accomplishments in the following areas:

- national commitments to policies and programmes supportive of health for all;
- improvements in mortality and morbidity rates;
- improvements in life style and related health measures;



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- improvements in coverage and various aspects of the quality of care;
- improvements in the health status and coverage of disadvantaged and marginal subgroups in the population.

## BEHAVIOUR AND HEALTH

One of the significant changes of the twentieth century is the growing recognition that it is possible to employ scientific methods to gain a better understanding of human behaviour. The task is difficult and complex, but human behaviour can be observed systematically, reliably, and reproducibly. As knowledge progresses, observations can be increasingly quantitative and have considerable predictive power. Human behaviour is sufficiently regular to permit dependable, specific propositions about patterns and themes. Increasingly, it is possible to clarify underlying causes. To do this, it is necessary to consider the intimate transactions of genetic and environmental factors and to take into account the rich variability of individuals and societies.

The heaviest burden of illness in technologically advanced countries today is related to individual behaviour, especially long-term patterns often referred to as "lifestyle". Epidemiological studies show that in such countries about half the mortality from the 10 leading causes of death can be traced to health-damaging behaviours such as heavy smoking, high alcohol intake, excessive calories and fat, inactivity, and reckless driving. Other behaviours highly relevant to health and disease - both mental and physical - are responses to the stresses of life events.

The health problems of the developing world are no less related to behaviour, not only in mental illness, nutrition, sanitation and family planning, but also from alcohol, smoking and vehicle use. Thus the lifestyle factors identified in developed countries are also important to developing countries. Smoking, for example, a major cause of cardiovascular disease and cancer which contributes to many other chronic illnesses, is on the rise in developing countries. Alcohol use is also on the increase. Diet, in the form of malnutrition, probably has its major impact on infectious disease, the most common cause of chronic illness. The problem of nutrition is of course directly related to the availability of food, but even when food is available it may not be used in the diet in ways needed to prevent malnutrition.



Breast-feeding is an important resource for nutritional, immunological and fertility reasons, yet poses difficult behavioural problems in the modern world.

Since about half the population of developing countries consists of children and adolescents, developing countries would benefit greatly from research on behaviour and health. Rapid social change causes family disruption and social disorganization and can affect developmental processes. Other problems requiring investigation include the effects of changes in breast-feeding customs; child neglect, abuse, and understimulation; effects of changes in family structure that occur with increased industrialization, migration and uprooting; ways of changing hygienic practices related to drinking-water supply and sanitation; issues related to family planning; the effects of mass migration (both within countries and across countries).

It is already known that the most effective interventions for diarrhoeal disease are those that interrupt the transmission of infectious agents in the home. There are well-documented findings showing the importance of fecal contamination of food and water in the home, and the effectiveness of simple actions such as handwashing in preventing infection. But the literature on diarrhoeal diseases is sadly lacking in field studies designed to show how to make household hygiene effective in poor countries. Such studies could have great practical benefits in a relatively short time, and could help to instill health habits with long-term gains. Hygienic measures, particularly hand-washing and instruction on the effective use of scarce resources such as water and food (for example, how to use indigenous foods in the weaning period) should be included in measures to combat diarrhoeal diseases, the major killer of the young in less developed nations. Behavioural research can largely help this approach.

There is a great need to strengthen capabilities for research on health and behaviour in the developing world, particularly research concerned with patterns of living that protect against major risk factors.

Major advances are being made in understanding the nervous system, with identification of neuroregulators, the chemicals that control communication among nerve cells. There is increasingly sophisticated research on the coordinated response of the nervous and endocrine systems to stressors. Both genetic and environmental factors pertinent to individual

responses are being specified. Such research promises to reveal the steps between exposure to a stressor and subsequent development of a disease. That knowledge is needed to devise better therapeutic and preventive interventions for health-damaging physical and emotional stressors.

In the 1950s, investigators discovered effective drug treatments for major depression, mania, and schizophrenia, as well as antianxiety agents that are used for a variety of physical and mental problems. Research into the actions of such drugs has greatly enriched knowledge of how the brain works, leading in turn to biochemical hypotheses about major mental disorders that have influenced clinical research and practice. The surge of knowledge within the neurosciences has been fostered by many technological innovations. Thus, one new technique makes it possible to study in normal human beings localized changes in brain activity during the performance of specific behaviours.

Similarly, the psychological and social sciences have helped both to define the effect of environmental factors on the onset and course of mental disorders and to create treatment options either as an alternative to drugs or in combination with them. It is encouraging that there are clear indications that biologically and psychosocially oriented investigators and clinicians are willing to explore the interface between their fields. Such collaborative efforts add a new dimension to progress in this vitally important area.

The burden of illness rests disproportionately on the socially disadvantaged. A growing body of research looks at the effects of such factors as different treatment by health care professionals. Inquiries into the cumulative effects of psychosocial and economic stress show promise of identifying mechanisms by which the environment can influence the health of the disadvantaged. Thus, even though the physiological mechanisms are not well understood, the influence of social disadvantage on the development of disease, on recovery opportunities, and on survival changes are becoming increasingly clear. Studies of the effects of social disadvantage and of intervention programmes present important opportunities for research which should attempt to identify preventable causal factors.

Preventive interventions in early life may have life-long benefits. With the control of infectious disease in more developed countries, behaviour-related disorders have become more dominant. Recognition of this shift and a



growing realization of the need to rethink strategies for child health have provided impetus to a number of in-depth assessments of child health care needs. Available interventions take several forms. Some, including neonatal metabolic screens are designed to identify problems before they do permanent damage; others, for example immunizations, help to forestall some future risk; still others such as dental hygiene can provide the child with a more general orientation toward prevention. All are important and require active collaboration between parents, schools, other community organizations, and the health professions. Child care that promotes health development has many facets that require understanding, especially in rapidly changing environments.

Research is needed in all of these types of prevention. Thus, efforts continue to develop new techniques for earlier, safer, and more reliable detection of abnormalities and new vaccines against dangerous infections. Behavioural factors are present in all such efforts. Attention must be given to learning how to enrol parents in disease prevention and health-promoting activities for their children. Progress in this area promises both to decrease the burden of illness and to increase the quality of life.

In recent years, increasing attention has been given to adolescence as an important, and developmentally complex period of life. It is a stage in which there are many forms of experimentation, both appropriate and inappropriate. Some behaviours affect health immediately - venereal disease or a severe accident related to alcohol use. Sometimes the deleterious effects appear only later in life, for example, cardiovascular disease from life-long health-damaging habits.

Until recently the crucial phase of early adolescence was seriously neglected. These years are critical for formation of health-relevant behaviour patterns of enduring significance. Also important are efforts to design better health education and strategies to promote health enhancing behaviour in adolescents, and to prevent adoption of such habits as cigarette smoking and drug use. An area of special concern is early adolescent pregnancy. The complexity of the issues creates a formidable research agenda, including evaluation of the role of such institutions as schools and hospitals in adolescent pregnancy, and creation of new programmes to help lower the incidence of adolescent pregnancies or provide ways of improving the lives of teenage mothers and their infants.

The human species is intensely social. This fact is so much a part of daily life that it is easy to overlook its significance. People everywhere are organized into societies. They repeatedly must choose between serving individual interests and those of the group.

In modern times, the fundamental human propensity for attachment is expressed in a largely unprecedented sociotechnical context. In advanced industrial societies, especially those characterized by high geographic mobility, the family is often so scattered that relations among its members are changed and attenuated. The (nuclear) family is no longer the basic unit of production. Mass media enter intimately into family life. Schools have taken over some family responsibilities for preparing the young for the future. The emergence of large social units engendered by the needs of industrial production and made possible by advances in technology of communication and transport paradoxically decreases opportunities for close human relationships and makes it difficult to sustain the unity of purpose of small groups.

Many of the developing nations are undergoing rapid social change. These changes are having important effects on physical and mental health. They involve urbanization, industrialization, and large-scale migration as well as prolongation of uncertainty about adult roles, unemployment, vast increase in scale of the community of reference, and greater cultural heterogeneity. Taken together, these factors tend to weaken and even rupture the fabric of traditional cultures and attenuate their socializing, orienting and supportive functions. This weakening of traditional family and community roles may have a critical impact on health-relevant behaviour, especially when the vital social functions are not supplanted in other ways.

Many changes in society are positively valued by the participants. People move in search of economic, social, and environmental opportunities. Modern communities, particularly in rich countries, provide facilities and choices for those with good health and economic circumstances. In some cultures, privacy and independence are valued along with attachment and a sense of belonging. In many settings family ties are built more on common interests and mutual attraction than in earlier times, when social and economic circumstances offered people few choices. Though non-family relations have become exceedingly important in recent times, family relations and those of its traditional functions that remain (e.g., maintenance of



life-long ties and child rearing) are still a significant element of the social support networks that are conducive to health.

The role of social support networks in mediating the effects of stress is a matter of growing interest, both in promoting health and in responding to illness. Disruption of social ties and community contexts is highly stressful for many people. Such disruption can occur for both positive and negative reasons. These include moves to a new job, community, or school; loss of spouse; impaired health; loss of income or employment; forced migration; natural disaster and wars.

Support systems are attachments among individuals that tend to promote mastery of difficult experiences by offering guidance about tasks and strategies, identifying personal and social resources, and providing feedback about behaviour that fosters improved competence. The cumulative findings from such studies strongly suggest that social support can foster health and promote recovery from illness.

There is need for further understanding of the relations between stress, illness, social support, and the utilization of medical services. One example of exceptional interest is research into the relationship between human attachments, illness, and mortality. It is providing evidence that people whose human attachments are weak are more prone to illness and early death. Although the mechanisms of vulnerability are not yet clear, it appears that support systems can buffer stressful experiences. Such networks can influence the use of health services and the adherence to medical regimens. This is pertinent to behaviour change such as smoking cessation or sanitation practices. Social support systems facilitate the development of coping strategies that help people to contain distress within tolerable limits, maintain self-esteem, preserve interpersonal relationships, meet requirements of new situations, and prepare for the future.

Another stimulating approach is that of stress research, an area in which brain, behaviour and health relations were first studied in a systematic way. An impressive body of knowledge has been accumulated over the past several decades. This can now be applied to a variety of human experiences such as work, family disruption and major life transitions. Stressful life experience

has been related to endocrine and cardiovascular function as well as to the development of coping skills and susceptibility to various diseases.

Basic research has provided knowledge of human adaptability and tolerance limits that can be used in shaping work conditions and in guiding technological advances in such a way that stress related to work or other demands can be kept within tolerable limits. Study of stress at work may be of particular interest because it is strongly related to the introduction of new technology. The work environment is the site of the most dramatic transitions brought about by technological advances. The benefits of technological advances in terms of increased productivity and reduction of physically dangerous jobs are well recognized. At the same time, increased mechanization and automation may cause negative physical and mental side effects that can probably be avoided if sufficient attention is paid to the psychological needs of workers.

High priority should be given to epidemiological research aimed at pinpointing behaviour-related problems in specific communities, cultures, countries and regions. To conduct such research, rapid culture-sensitive assessment techniques are needed. Despite the immense cultural variability that makes it difficult to devise effective means of influencing health-relevant behaviour, certain basic principles can be applied universally. A central question to be addressed is one common to developed and developing countries: how to present the facts of health and behaviour in a way which arouses and sustains the motivation of individuals and communities to adopt health-fostering behaviours. It is important to identify programmes that have succeeded and to analyse elements which may be transferable with appropriate modification to other situations and cultures. In both developing and developed nations there is a need to encourage greater cooperation and collaboration between biomedical and behavioural scientists.

The evidence of the past decade demonstrates that, at least for cardiovascular disease, large-scale interventions are effective. The encouraging results of some smoking prevention programmes have positive implications for prevention of the most prevalent types of cancer and for chronic pulmonary disease and cardiovascular disease. Much remains to be learned about cost-effective methods of conducting such prevention efforts: for example, how to select the optimal medium for specific kinds of message. Although knowledge about learning already is substantial, it needs to be applied more



systematically in prevention programmes. Furthermore, recent years have produced evidence that individuals often have great difficulty in changing their lifestyles, even in the face of clear risks to health. Thus, research on prevention must not only determine which behavioural changes are potentially beneficial but also show how such changes can be adopted and maintained.

Community-based efforts to change behaviour for health are eliciting worldwide interest, and attention is being paid to a scientific basis to enhance their effectiveness. How is it possible to change behaviour for health without coercion? This involves analysing cultural values, and determining the specific knowledge deficits in a community with respect to health. It involves social learning, including the skills necessary to maintain health-promoting behaviour. It involves learning how to utilize motivations, for example, those of pregnant women to provide the best protection and care for their babies. It involves finding the channels through which members of a particular population may understand, and take seriously information pertinent to their own health. These community-based efforts promote lifestyle changes that are difficult to achieve, and research is necessary to clarify the conditions under which the changes actually occur (for example in preventing heavy smoking or heavy alcohol use, and in improving nutritional, family planning and sanitation practices).

Specifically, there appear to be several key elements in any effort to promote major behavioural changes affecting health:

(1) Establishing the facts: accurate biomedical and behavioural information about risk factors in a community;

(2) Clarifying the psychosocial obstacles to health-promoting behaviour change;

(3) Utilizing modern behavioural and social sciences, including communications research, to learn how to reach a given population in a meaningful way so that opportunities for promoting health may be fully understood by the population;

(4) Employing the social sciences and media strategies in fostering community-based participation conducive to changing behaviour for health;

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(5) Continuing the programme for a period of time long enough to allow a climate for change to develop and community organization to maintain health-promoting behaviour as an enduring feature of the culture.



## BIOMEDICAL RESEARCH AND ITS IMPACT ON HEALTH CARE

The expansion of knowledge through biomedical research during the last 25-30 years has been remarkable, as has the use of this knowledge in practical health care. Research in many disciplines, ranging from biochemistry to different clinical specialties, has contributed to this knowledge but the most important and far-reaching contributions have undoubtedly come from molecular biology. From the discovery of the double-stranded DNA and the genetic code to recombinant DNA techniques, molecular biology has advanced at a pace and in a way that could not have been foreseen thirty years ago. The tools of molecular biology are now becoming indispensable in many areas of biomedicine.

Perhaps the most significant breakthroughs so far as a result of research in molecular biology have occurred in the domain of genetics. Genetics has become molecular genetics. From a primarily morphologic discipline, genetics today describes its findings in terms of molecular biology. The number of structurally defined genes increases at a rapid pace. Many researchers think it probable that by the year 2000 most of the 50-100 000 genes in the human genome will be known.

Although advances in molecular biology in recent years have been rapid and with sometimes unexpected repercussions it should be borne in mind that much other biomedical research has made important contributions that will lead to improved health care. The advance of immunology has been particularly noteworthy. The most spectacular single advance is the hybridoma technique and monoclonal antibodies. The increasing knowledge of the mechanisms by which our immune system functions will provide additional tools for our fight against infectious diseases and against cancer.

Studies of virus-induced cancers have led to the discovery of oncogenes. In work on different growth factors it has been found that these proteins are very similar to those coded for by some oncogenes. It can be anticipated that future research on mechanisms of expression of oncogenes and action of growth factors will shed light on cellular growth under normal and pathological conditions.

Neurobiology and neurochemistry are other areas that have progressed beyond expectations. The analysis of the mechanisms of nerve impulse transmission both in the central and the peripheral nervous system has provided results that have applications in treatment of disease. In recent years a number of neuropeptides - up to now about 40 - have been detected and structurally determined. Knowledge about the biological function of these neuropeptides is at present very limited but it can be safely assumed that these compounds play important roles in the function of the nervous system. Research in this area is also intense, and information about the physical as well as the behavioural (see Annex 2) influences of these substances is increasing rapidly.

Biochemistry and cell biology have advanced substantially. Work on metabolic pathways was in essence finished by the end of the 1960s and the researchers turned to analyzing the regulatory mechanisms of metabolism as well as cellular function and the interplay between cells in different organs. Studies on receptors and hormone action have provided insight into functional mechanisms with implications for diagnosis and treatment. New biologically active compounds have been isolated; for example, cyclic nucleotides and the family of arachidonic acid metabolites, (prostaglandins, prostacyclin, thromboxanes and leukotrienes).

In physiology and pharmacology perhaps the most important contributions deal with the understanding of drugs and drug action. The realization of individuality in response to drugs and the synthesis of knowledge to turn drug design from haphazard synthesis of a large number of compounds with more or less known possible effects to tailoring of compounds on the basis of knowledge of physiological mechanisms are advances with far-reaching implications.

The developments in clinical sciences should not be underestimated. In these are included advances in diagnostic as well as therapeutic procedures. In the case of diagnostic procedures it should be emphasized that in many instances the advances have depended on techniques in sciences outside of those normally included in biomedical sciences, for example physical and mathematical sciences. In therapeutic advances the background is multifaceted, ranging from results of basic sciences to developments in the



clinical sciences themselves. Suffice it to mention that in developed countries some 50%<sup>1</sup> of cancers are cured today, that the advent of artificial joints have changed in a remarkable way the lives of those afflicted by various forms of arthritis, and that transplantations of organs have given new hope to some formerly condemned to premature death.

Numerous other examples could be cited but the aim has been to present a brief background to advances in health care that can be visualized on the basis of increased knowledge provided by biomedical research, in particular involving basic research. In presenting these prospects it is possible to choose different ways, e.g. one based on major diseases, another based on biomedical advances. The possible or probable impact of biomedical research will be discussed in relation to different groups of diseases. It should be emphasized that no attempt has been made to make the groups of diseases complete. Rather, the aim has been to give examples within groups of diseases.

### Infectious diseases

Infectious diseases, whether of bacterial, parasitic or viral origin, can be considered in a world-wide perspective to be the most important group of diseases to attack. In the present state of knowledge this effort is likely to be more successful than those directed at many other diseases. The major factors behind this supposition are the advances in molecular biology and immunology. The knowledge about the chemistry of microorganisms and the mechanisms of their replication offer possibilities to produce vaccines specific for important structures responsible for infectivity of the microorganisms. At the same time, this way of attacking the problems of vaccine production decreases or eliminates unwanted side-effects of vaccines. Recombinant-DNA technology has provided a means of preparing immunogenic material at reasonable cost. A particular advantage with this technology is that deletion mutants which lack certain virulent genes can be prepared. These mutants will be antigenic, but safer than vaccines prepared by procedures currently used. Another possibility for vaccine production involves utilization of subunits or components of microorganisms. Such vaccines will contain parts that are antigenic but lack components that may cause infections or other unwanted side-effects. Still another approach is preparation of vaccines containing crucial, antigenic peptides. The possibilities of this procedure are difficult to assess at present; there is a

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<sup>1</sup> Average five-year survival rate for the most frequent cancers.

problem of protein conformation, that these peptides must resemble in a three-dimensional way the structure of the whole protein in the membrane of the microorganisms.

Vaccines may also be constructed as anti-antibodies which act as antigens and elicit immune response. There is already experience from experimental systems that anti-idiotypic vaccines are effective in viral diseases such as hepatitis, influenza and polio and in parasitic diseases such as trypanosomiasis.

When parasites are considered, for example, malaria, it can be assumed that vaccines will contain proteins from different stages of the evolution of the parasite. By such a design it will be possible to attack the parasite at different stages of its life cycle.

A problem with vaccines that is not yet satisfactorily solved is that of adjuvant. To make the vaccines optimally effective adjuvants are needed. It can be assumed that research on the regulation of the immune system will provide knowledge about suitable and effective compounds that stimulate the immune system.

In discussing vaccine production the role of the use of monoclonal antibodies should not be overlooked. Monoclonal antibodies constitute an invaluable instrument to define antigens relevant for induction of protective immunity or mediation of pathologic response. They can be employed in purification of antigens to be used as vaccines.

Overall, the prospects of controlling infectious diseases in the coming decade seem good and can be attributed mostly to breakthroughs in biomedical research such as recombinant-DNA and monoclonal antibody techniques. It should be added that basic biomedical research also will provide better instruments for vector control. Suffice it to mention elucidation of the chemical structures of many sex attractants in insects.

### Cardiovascular diseases

Cardiovascular diseases are the foremost cause of death and disability in the developed countries. If the prospects of making great progress in the elimination of many infectious diseases in the coming 10-15 years are good,



the prospects of decreasing morbidity and mortality in cardiovascular diseases in the near future must be considered less favourable. Unquestionably, risk factors such as high fat intake and smoking have been identified and suitable changes of lifestyles will undoubtedly have an impact. However, from a research point of view much knowledge is lacking. It is rather striking that the very considerable research efforts so far made in the field of cardiovascular diseases have not yet provided breakthroughs comparable to those bearing on, for instance, infectious diseases. There is no question that additional information is needed on relationships between diet and cardiovascular diseases and between lifestyles and these diseases. When the reasons for the marked decrease in recent years in ischaemic heart disease in some countries, particularly the United States of America, are known, better instruments may be available for prevention.

An approach to causation of cardiovascular diseases, apparently different from that of diet and lifestyle factors, involves the platelets. Recent research has shown that aggregation of platelets - an early phase of blood coagulation and thrombus formation - is regulated by the interplay between the arachidonic acid metabolites prostacyclin and thromboxanes - the former preventing aggregation, the latter stimulating aggregation. It is conceivable that a change of the normal process of platelet aggregation may be important in cardiovascular disease. If so, we can visualize a treatment modality based on inhibitors or stimulators of prostacyclin and thromboxanes. In this connection it might be mentioned that large-scale trials of the effect of aspirin on cardiovascular diseases, notably a stroke, are in progress. The rationale of using aspirin to decrease risk of a stroke (for example) is that aspirin inhibits an early stage in the transformation of arachidonic acid into metabolites such as prostacyclin and thromboxanes.

Of course the long-range aim should be prevention, and present knowledge is insufficient. Yet prevention is unlikely to provide the sole solution.

### Cancers

Cancers are responsible for about 25% of all deaths in developed countries. The advances in treatment of cancers in the last few decades have been remarkable. In these countries, through surgical, radiological and drug treatment it is estimated that perhaps 50% of cancers diagnosed are cured.

Early diagnosis has contributed to this progress. Prevention also plays a significant role; elimination of tobacco smoking, for example, would be a very important step. Yet such measures, however important, would not eliminate all cancers.

Considerable resources have been spent on cancer research in the last decades. Very valuable information has been gathered basic to our knowledge about cell function, and some major breakthroughs are of recent date. Again, recombinant-DNA technology and monoclonal antibodies have been instrumental. Through these techniques we learn about regulation of cellular growth under normal and pathological conditions. The time perspective is long-range, and it is unwise to speculate further on practical applications of knowledge on, for instance, oncogenes. However, with respect to use of monoclonal antibodies we can see already the potential value in diagnosis and treatment. Monoclonal antibodies or monoclonal antibodies made toxic by arming them with radioactive or toxic compounds will find use in treatment of cancers. Monoclonal antibodies are already successfully employed in therapy connected with bone marrow transplantation and treatment of lymphomas. The future developments will depend on production of human instead of murine monoclonal antibodies. It is probable that procedures for production of human monoclonal antibodies will be available in the near future.

More or less circumstantial evidence indicates a causal relationship between composition of diet and cancer. However present knowledge does not permit firm conclusions, and research on the relationship between diet and cancer must be given high priority.

### Psychiatric and neurological diseases

The progress made in the area of neurobiology promises great hope for better means of treating psychiatric and neurological diseases. The meticulous and painstaking work on clarifying neurotransmission has already provided important tools for treatment of disease. A classical example is Parkinson's disease which is characterized by deficient production of dopamine. Administration of dopa - a precursor of dopamine - to these patients is a standard procedure today. There are prospects that Parkinson's disease may be treated by transplantation of nervous tissue.



Many psychiatric diseases are likely to be associated with disturbances in neurotransmitter production or metabolism. Recent examples are depressive disease which can be associated with decreased serotonin production and Alzheimer's disease which is associated with deficient acetylcholine production. Knowledge of the biochemical alterations provide tools for substitution therapy or for drug design. In fact, it can be assumed that as knowledge about the mechanisms of function of the nervous system under normal and pathological conditions increases, instruments will be provided for design of increasingly efficient drugs.

### Inherited diseases

Some 3000 genetic disorders are known today. The protein abnormality has been defined in about 300 of them. Thanks to the rapid development of molecular genetics it is becoming increasingly possible to localize the genes responsible for disease. Even if the defective gene product is not known it is possible to localize the gene. In recent years, the genes responsible for several genetic diseases have been identified, for example, haemoglobinopathies, some haemolytic anaemias, haemophilia, Huntington's disease, some muscular dystrophies. Although most genetic disorders are rare diseases they must be considered very important, not least to the families afflicted. The development of molecular genetics will not only give information on defective genes and their diagnosis, but will also provide tools that can be used in treatment. As difficult ethical considerations are involved, this so-called gene therapy will be controversial.

### Endocrinology and endocrine diseases

In a global perspective the most important issue under this heading is not a disease; it is human reproduction. Undoubtedly, biomedical research will provide new methods for contraception, different from those presently employed and therefore probably more acceptable; for example a "day-after" pill. In this connection it should be mentioned that research in biobehavioural and social sciences should play an important role in devising appropriate means for control of population growth.

Quantitatively, the most important endocrine disease is diabetes mellitus. Intense research is in progress, particularly on type I diabetes. It can be assumed that within the next few years sufficient knowledge will have

accumulated concerning the autoimmune reactions behind elimination of B-cells from islets, to allow design of completely new methods for treatment. Basic research on mechanisms of hormone action, including studies of hormone receptors, may lead to production of more suitable and specific drugs to be used in various endocrine diseases.

#### Allergies and autoimmune diseases

The discovery of a new type of arachidonic acid metabolites, the leukotrienes, and their involvement in allergic reactions holds great promise for new means of treating allergic diseases.

With respect to autoimmune diseases we can foresee developments of the type described above for diabetes mellitus type I. Treatment may not only involve monoclonal antibodies but also compounds that modulate the activity of the immune system. Such developments may be a fruit of increasing knowledge about the regulation of the immune system. Drugs of this type may also be useful in treatment of allergies.

In this summary some examples have been given of possible or probable improvements in health and health care as a result of ongoing and future biomedical research. Needless to say, there will be numerous advances in diagnostic, therapeutic and prophylactic procedures only hinted at or not mentioned. Improvements in health and health care will of course depend not only on biomedical research but also on research in many other disciplines, not least behavioural and social sciences.



## HEALTH SYSTEMS RESEARCH

1. Although there have been great advances in health science and technology during recent decades, the health conditions of the majority of people, particularly in the developing world remain highly unsatisfactory and a cause for deep concern. One reason for this, apart from scarcity of resources and the other consequences of underdevelopment, is that health delivery systems in most countries have been unable to absorb the technologies and to bring them within the reach of the majority of their populations. Considering that health needs are specific to a country, and that the practice of health can be vastly different between countries and within a given country, it is apparent that advances in science and technology can play only a limited role towards fulfilment of the goal of improved health by the year 2000. The crux of the problem, and the challenge for the future lie in the assimilation, adaptation and modification of the technologies already available so as to make them more relevant, appropriate and applicable to the needs of the community and the health care system into which they are to be integrated. The selection and utilization of health technologies and the provision of health services appropriate to the prevailing needs and conditions constitute the field of health systems research (HSR).

2. Health systems research is concerned with strengthening the means of health promotion and health care. It begins with existing field problems and uses a variety of research disciplines to apply scientific knowledge for improving health care and health status, bridging in this way the wide gap that now separates knowledge and action in health. Characteristics of its methods are: (1) reproducibility (solutions applied to similar problems and conditions elsewhere would produce similar results); (2) ability to identify key elements of a problem which make research approaches from one setting applicable in another setting; (3) understanding of causation, so that relationships between actions and impact can be organized in concepts and theories that may be usefully applied to the prevention or modification of health problems generally. The fundamental principle is that the questions studied should be relevant to the everyday concerns of policy-makers, administrators, or others responsible for health promotion and health care.

3. The prime purpose of health systems research is to help improve the health status of the people by improving the quality of the health service. Early efforts in health care research focused on problems encountered in health services only. However, the health status of a community is the outcome of several interacting factors, hereditary and genetic determinants, the effects of the environment, the behavioural pattern and lifestyles of the individual, the development and provision of health services. This means that health depends to a large extent on variables outside the health services and that the health delivery system is but one of the sub-systems that contribute to health status. For this reason health systems research goes beyond a narrow concern with government programmes, and comprises the private sector, indigenous health practitioners, the efforts of the community, and intersectoral influences on health. It is obvious from the foregoing that health systems research depends upon a variety of disciplines - social sciences, statistics and management - in addition to the biomedical and health sciences proper. The deployment of these disciplines depends upon the matter under study, which may range from a comprehensive study of health care as a total system to a small problem (such as how to encourage mothers to use the oral glucose-salt solution or how to improve the early diagnosis of leprosy).

4. Health systems research aims to improve understanding of the structure and functioning of the health system and to achieve more rational policy and programme planning by providing decision-makers with evidence as to which health policies are likely to be most effective, efficient, economic and relevant to their needs. Since the central and overriding policy commitment of WHO is to the goal of health for all by the year 2000, attention must be turned to its implications for health services, health systems and health policies.

The five sets of ideas referred to in Annex 1 capture the central meaning of health for all and its interaction with primary health care; they also identify some critical policy and programme areas where health systems research can play an important role.

5. The following broad categories of subjects can be derived from the guidelines outlined above. In the context of the local or national situation health systems research shall:



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- demonstrate the place of health systems in society as a whole and indicate the need for intersectoral action in analysing health problems and proposing solutions;
- assess health needs by using many different ways of measuring morbidity, mortality, disability, impairment, and other health indicators, and demonstrate how health needs are transformed into political demands;
- throw light on the availability and deficiencies of health resources, including health manpower, establishments, equipment and supplies (including drugs), and knowledge;
- analyse the structure, functions and deficiencies of health systems as a whole, including the profit-making private health care sector (modern and traditional);
- determine the conditions for, and the effects of, alternative patterns of health care delivery, in terms of feasibility, quality and costs;
- analyse and quantify the dynamics of the economics of health systems;
- analyse management problems, including health planning, administration, and regulation so as to achieve greater managerial efficiency;
- study the most suitable methods of encouraging community involvement under various sets of conditions, and determine the effects of such involvement;
- evaluate the effects of health programmes by analysing their structure, process, and outcome.

Specific problems providing an incentive for health systems research may arise within any one of these subjects, but it is important to realize that the solution to any problem may require research in one or more of the other subjects.

6. While most health systems research should be concerned with the kinds of immediate activity outlined above, there are also good reasons to conduct more fundamental field research. Even a relatively small effort to clarify fundamental issues and contribute to basic knowledge can be important for both immediate and future application. Examples of fundamental issues requiring field research are:

- Equitable distribution

The concept of "health for all by the year 2000" includes a call for equity in health care. In addition to the more customary measures of effectiveness and efficiency, equity introduces a new parameter in measuring the outcome of health activities. Innovative approaches to gathering information are needed to monitor coverage, which can be defined as the proportion of people in need of service who actually receive it. If the definition of equity is founded on need, methods for defining such needs are not well developed and little has been done to measure coverage and to define the means of achieving it.

- Intersectoral action

That health depends largely on factors outside the health system is a basic dogma of the primary health care movement. Under conditions of under-development, improvements in education, water supply, housing, food supply, transport, communications, and the role of women, produce important long-term health benefits. As with community involvement, recognition of the need for intersectoral cooperation does not mean that we have learned how to promote this cooperation in national programmes. Research and development activities are indispensable for a better understanding of socioeconomic determinants of health, and to develop mechanisms for effective intersectoral action at different levels.

- Community involvement

Community involvement is stressed as essential for development of health system infrastructures and the organization of health systems based on primary health care. Even though the general



concept of community involvement has gained widespread support, there is little agreement on what the term means and little practical understanding of how it can be achieved. Therefore it is essential to clarify what is expected from lay participation in health, including self-care, family "cover care", forms of indigenous social care-giving institutions, new social forms of health care, new social movements, structures for citizen and patient participation and new forms of legislation affecting health consumerism. Health systems research has to determine the approaches that are most likely to succeed, and to evaluate the effects of various forms of community involvement.

- Policy analysis

Many Member States have expressed political commitment to the goal of health for all and have set into motion national processes for policy and strategy formulation and implementation. The way policy and implementation decisions are taken in a country depends largely on sociocultural and political traditions, and these determine the features most susceptible to change as well as the major obstacles to improvement. The decision-making process - how policies are made, translated into action and evaluated - is a major challenge for health systems research. An important corollary is how research can support health policy making: the *raison d'être* of health systems research is indeed the impact of its results at the different levels of decision-making.

7. It should be noted that health systems research is still at a relatively early stage of development. Most countries, particularly the developing countries, have not yet integrated such research into their managerial process for health development. This rather slow development is due to different constraints, including the lack of expert advice and skills. Trained and experienced staff, capable of proposing, designing and carrying out health systems research, are scarce, especially in developing countries, and opportunities for training locally are often very limited. If research is to become part of regular activities in the health system, technical skills should

be developed or consultation made available so that any health or community worker can carry out or participate in appropriate studies. The building up of local capabilities in health systems research should be the result of exposure and involvement in concrete field work, supplemented by a more formal learning process whereby a general understanding is obtained of the approaches and methods available.

8. One of the greatest problems for investigators conducting health systems research is a sense of isolation; there are few people with whom they can associate. It is essential, therefore, to have at least one research group or institution that will provide the necessary multidisciplinary basis and intersectoral coordination. Experts in the key disciplines should be brought together on either a full-time or a part-time basis to work together as a team in continuing field projects. At least one such institution - or network of institutions - should be developed in every country with support from national and international sources.

9. For the full potential of health systems research to be realized, it is not sufficient to improve the quality and quantity of research, it should also be responsive to the needs of those who manage health services. The latter, in turn, should be willing to use the results of research in addressing problems associated with rapid expansion of primary health care systems. Decision-linked research is one approach to this goal. The starting point is identification of information needs for decision-making through interaction between decision-makers and researchers. Research is then designed, a priori, to respond directly to these needs. Decision-linked research requires national mechanisms whereby health policy-makers, planners and researchers can get together and jointly define needs, as well as ways of satisfying them.



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## THE OPERATIONAL APPROACHES OF WHO

The research efforts of WHO have to be seen not only in the light of the much larger research activities which they catalyze, but also of the severe constraints which prevail in the developing countries. The need for more efficient management and utilization of resources available to the health sector constitutes a major preoccupation.

Research activities may have to be focused on a particular health problem, on a proposed intervention, or on the managerial process itself which is implementing the change. In some instances new scientific knowledge needs to be acquired, and in others, existing knowledge will have to be applied in terms of appropriate technology.

These general considerations apply to all WHO programmes, as do the common approaches mentioned in the report (see page 47, "The operational approaches of WHO").

The environment and health

In the report of the Subcommittee a distinction is made between the hazards to which human beings have long been exposed, and those which have arisen in the last few centuries in association with industrialization. Operationally, this distinction breaks down, and it is necessary to take together the wide range of hazards embraced under WHO's programme. The goal of health for all is inextricably linked with a better environment and quality of life; yet the relationship between health and the environment is unsatisfactory in practically every country. The social consequences of adverse environmental conditions are only too obvious: people who live in substandard sanitary conditions, without adequate water supply or waste disposal facilities, who fall ill as a result of eating unsafe food, or who are exposed to increasing concentrations of chemicals in the environment in which they live and work cannot be expected to lead socially and economically productive lives.



Environmental health problems are to some extent correlated with the level of national socioeconomic development, although a high level of development does not exclude the possibility of health problems originating in the environment. Indeed, as industrialization progresses, environmental problems do not disappear - they only change in nature. In the developing world, problems of communicable diseases associated with poor environmental sanitation and food contamination persist, but even here environmental pollution is occurring on a large scale and risks of chemical hazards must be controlled.

The need to expand present knowledge of the nature of new environmental hazards is an important concern of WHO. This area, in which research and the sharing of experience and information between Member States can be particularly fruitful and economic, continues to be the prime objective of WHO's efforts in the area of chemical safety. The goals include the assessment of the adverse health effects of the most important chemicals. In addition, attention is given to the development of cheaper and more rapid methods of testing chemicals and assessing their risk, and to manpower training.

In respect of basic environmental sanitation and the prevention of food contamination, immediate action rather than further research is required. The adverse effects of unsafe water, the insanitary disposal of human waste and the contamination of food by pathogens are, with few exceptions, generally known. The major constraints to progress are the lack of sound planning and the difficulties involved in mobilizing the community and its resources. The Organization thus continues to promote the global goals of safe water and adequate excreta disposal for all by 1990 as decided for the International Drinking Water Supply and Sanitation Decade.

In the area of food safety, WHO pays particular attention to promoting the awareness by consumers of the health hazards associated with unsafe food, and how they can be prevented by action at the level of the home and the community.

As regards environmental health in rural and urban development and housing, WHO concentrates on an advocacy and information role, to ensure that environmental health considerations are taken into account in development planning and projects. This problem persists in many developing

countries because of the rapid changes brought about by the introduction of new technology for industrial and agricultural production. WHO emphasizes, through its technical cooperation plans, the further development and application of methods for the assessment of environmental health impact; training; and the use of the substantial body of experience that has become available during the last few years, much of which, suitably adapted, can be of use to national health agencies.

Since environmental health conditions vary substantially from region to region, WHO seeks to ensure, through innovative approaches, that adequate attention is given to new environmental problems as they emerge in different parts of the world.

### Population and health

"When we talk of 'population', people appear as mere statistical figures. But it is people who matter ..." (H. Mahler's address to the International Conference on Population, Mexico City, 1984). In addition to the numerical aspects, the qualitative aspects of the population-development problem should not be overlooked. "... People's creativity and ingenuity can outweigh theoretical calculations; but their apathy can turn planners' dreams into implementers' nightmares ..." (idem). Indeed it may be argued that social apathy is at the root of many factors which determine ill-health, such as unemployment and underemployment, low levels of education, primitive housing, poor sanitation, malnutrition and poverty, to mention a few. Nevertheless, it remains clear that a proper balance needs to be achieved between the number of people in the world and the world's resources.

In the preceding discussion limitation of numbers was recognized as the indispensable complement without which the advance in health due to improvements in food, water, hygiene and the like would rapidly have been eliminated. An appropriate balance between resources and numbers is essential for those countries which have yet to make the basic advance. But these countries vary widely in political, religious and cultural backgrounds, and the means by which the balance between resources and numbers is achieved will also vary.

The other aspect of population health should also be considered. Historically the decline of birth rates did not begin solely for health reasons; it began because parents recognized that by having smaller families they could



improve the quality of life for themselves and their children. This consideration has a powerful appeal to parents throughout the world, and is the reason for WHO's concern with quality as well as numbers in its approach to population problems.

In the field of human reproduction research, WHO seeks to promote, support and coordinate international research in human reproduction and family planning of special relevance to developing countries. Continued research is required to ensure the safety and efficacy of new and existing methods of fertility control and to develop improved methods and approaches to their delivery through the health system based on primary health care. None of the currently available family planning methods is wholly satisfactory, and there is a need to develop new methods for use at different stages in reproductive life. The health status of people in developing countries, their genetic constitution, diet and reproductive patterns differ not only among these countries, but also from those of the industrialized countries, so that authorities are reluctant to extrapolate data from one group to another. In addition, the delivery and acceptability of human reproduction technology is often specific to a given country, locality and culture, so that operational research must be carried out in and by countries themselves. National research capabilities therefore need to be strengthened.

WHO continues to encourage collaboration between governments and scientists in both research and institution-strengthening, and in particular in the joint identification of priorities, strategy planning, implementation of activities and quality assurance; the pharmaceutical industry should be involved when appropriate. WHO collaborates with other agencies through the exchange of information, joint planning, and joint activities between national, nongovernmental and international agencies. The results of research are disseminated to policy-makers, programme administrators, service providers, scientists and the public.

### Tropical diseases

We have emphasized the need for a comprehensive approach to diseases specific to the tropics, taking that term to include both noncommunicable diseases and the infections usually identified by the term tropical diseases.

Operationally WHO has several different approaches to these problems, approaches determined in the light of long experience. They include, for example, immunization, disease vector control, the prevention and control of parasitic diseases, of diarrhoeal diseases, etc.

Some of the approaches are common to several programmes, for example, the development of simple tools for epidemiological surveillance and monitoring of diseases and rapid simplified diagnostic techniques at all levels and particularly in district and rural health centres. Epidemiological surveillance is also used to define problems, establish priorities, and indicate coordinated, appropriate and timely action. Problem identification enables research to be undertaken to develop new and improved tools for prevention and treatment. Epidemiological profiles should make it possible to measure specific health and socioeconomic variables for which intervention would be warranted.

Research on diagnostic, prophylactic and therapeutic substances of recognized quality, safety and efficacy enables the health system to concentrate its resources on the most relevant supply of such substances for disease prevention and control.

Manpower development and training programmes have an important role to play, particularly in relation to epidemiology and immunology where important research needs to be coordinated for the development of new vaccines.

In the field of immunization, research is needed on improved vaccines and cold chain material and methods, on techniques for the sterilization of equipment and for vaccine administration as well as on strategies for vaccine delivery. The focus is on methods or strategies that can both increase impact and reduce costs.

In respect of the control of disease vectors, high priority is given to the strengthening of institutions in the endemic countries to further develop a network of collaborating centres for vector research, training and advisory services so that appropriate control strategies may subsequently be developed under every set of epidemiological and socioeconomic conditions.



On parasitic diseases, epidemiological assessment of the distribution, responsible ecological factors, and extent of each disease are the basis for priority setting.

A major research and development effort is currently under way to control six target diseases - malaria, schistosomiasis, filariasis, trypanosomiasis, leishmaniasis and leprosy. This effort is global in scope and is co-sponsored by WHO, UNDP and the World Bank. It aims at generating new fundamental and applied knowledge, including the development of new drugs and vaccines, as well as at strengthening the research capability of affected countries. The approach is multidisciplinary, spanning a broad spectrum of subjects from the basic biomedical sciences to socioeconomic and behavioural aspects.

This effort is and will remain a major "transprogrammatic" concern of the Organization, as it needs to be carried out in close coordination with other long-standing commitments in the areas of parasitic diseases, vector control and communicable diseases in general.

Basic research on the prevention and control of diarrhoeal diseases aims at significantly improved understanding of their biology and epidemiology and of the theoretical basis for prevention and control; operational research aims at testing managerial and technological innovations for improved implementation of control measures.

As part of the overall WHO programme of disease prevention and control, operational approaches have been similarly formulated in other problem areas such as acute respiratory infections, tuberculosis, zoonoses, sexually-transmitted diseases, blindness and noncommunicable diseases.

### Nutrition

Conceptually it is important to distinguish between health problems attributable to lack of food, excess of food, ill-balanced diets, and food contaminated by chemicals or microorganisms. Operationally, however, these distinctions break down; a health educator would be expected to cope with the anorexic as well as with the obese, and an administration would not assign the problems of food excess and deficiency to separate departments.

WHO coordinates the action of the health and other sectors concerned at the international level to support countries in defining and implementing coherent food and nutrition policies, with a view to improving the nutritional health of all population groups. Support and collaboration is provided with appropriate United Nations bodies - FAO, the World Bank, UNICEF, etc.

Research on mitigation and control of malnutrition in developing countries concentrates on community studies, involving a combination of social, cultural, economic, agricultural, epidemiological, nutritional and managerial experience. Particular emphasis is placed on improving nutrition of infants, children, pregnant or lactating women and other vulnerable groups (such as the elderly) as well as on the use of locally available food and improvement of food supply programmes. Special attention is given to the promotion of breast-feeding and adequate weaning practices for the improvement of infant and young child nutrition.

The nutritional side-effects of rapid urbanization in developing countries and of over-eating and dietary imbalance in affluent ones is combated through promotion of healthier life-styles and eating habits and improvement of mass catering practices. To generate the knowledge required to this end, further research will be carried out on food requirements for people at different ages and with different occupations.

### Maternal and child health

Infant mortality has declined dramatically as a consequence of improved nutrition, environmental measures, immunizations, etc., and there has been a striking reduction of perinatal mortality associated with better maternal nutrition, control of infections during pregnancy and delivery and improved obstetric care. Exposure to "deficiencies and hazards" in utero and intrapartum not only leads to high perinatal losses, but results in increased infant mortality, particularly because of low birth weight. There has been relatively little change in early fetal losses, most of which are determined at or soon after fertilization (see Fig. 1).

From this evidence it is clear that the advance in health in developing countries will come largely from improvements in maternal and child health. Operationally it is often difficult to distinguish between the two. Maladaptation for the mother is reflected in deficiency or hazard exposure for the fetus.



The Organization is providing technical and methodological support to strengthen the maternal and child health and family planning component of primary health care. Increased emphasis is laid on collaboration with countries in assessment, adaptation, development and field testing of appropriate technologies to cope with problems specific to pregnancy, delivery, the neonatal period and growth and development during childhood and adolescence. Special attention is given to: (a) the promotion of behavioural and nutritional patterns that foster health pregnancies; (b) the promotion of maternal nutrition and appropriate infant and young child feeding, with special emphasis on breast-feeding, in view of the protection it affords to infants; (c) the prevention and treatment of the complications of pregnancy, including those that may give rise to high perinatal mortality and childhood infections, including diarrhoeal diseases, acute respiratory infections and infections that can be controlled by immunization.

### Mental health

The World Health Organization's mental health programme is focused on three main areas of intervention:

- (i) prevention and control of mental and neurological diseases and of psychosocial problems such as alcohol and drug abuse;
- (ii) the application of knowledge about psychosocial factors in the provision of health care in general; and
- (iii) the development and use of knowledge about psychosocial factors in efforts directed towards socioeconomic development.

The wide scope of the programme required development of mechanisms for the selection of specific topics on which effort will be concentrated. These mechanisms include, for example, multidisciplinary and multisectoral advisory and coordinating groups at national, regional and global levels, and have allowed the identification of topics seen as priorities by Member States and relevant to the resolution of major public health problems.

One such area of the programme's concentration is the promotion and coordination of research on mental health and biobehavioural science. The development here began with a series of studies which had as their main goal the epidemiological assessment of problems and the development of methods

which will allow comparison of data from different countries and sharing of experience. A variety of such methods has been developed, and positive evidence of their applicability and validity has now been assembled. Several multicentric studies devoted to the exploration of the most prevalent disorders followed so as to obtain data on which to base preventive and curative measures. This effort included not only studies of mental disorders in the narrow sense (such as schizophrenia or depression) but also work on other problems such as those related to alcohol and drug abuse. Research on issues of importance for service delivery with emphasis on PHC followed and resulted in clear indications about ways of organizing delivery of services for those suffering from mental neurological and psychosocial disorders.

Next, research on community responses to mental health problems and ways to enhance preventive and health-promoting action, was stimulated. Parallel to this began the effort to obtain information about psychosocial factors influencing health and health services which would help decision makers to improve delivery of care and make it more efficient and humane. Examples of this work are studies on psychosocial aspects of female sterilization programmes and work on instruments which can help to assess quality of life of people with chronic disease and disability. Stimulation of research and coordination of studies in the field of neurosciences was added to the programme later, to facilitate acquisition of data necessary for the management of neurological disorders. This, as well as the series of biological investigations undertaken by a network of centres not only brought results of scientific importance but also contributed to the mobilization of the world's scientific community on projects which Member States have identified as being particularly important in the improvement of the health state of their populations.

A variety of disciplines have been involved in this effort, including psychiatry, epidemiology, public health, neurosciences, psychology, anthropology and others. A multidisciplinary approach has been used in most of the studies undertaken in the framework of the programme. Centres in some 40 countries are involved in these activities.

Collaboration with other programmes of the Organization remained a point of emphasis throughout the programme's life. Such collaboration proved to be useful and productive. In a number of such projects, the mental health programme was able to provide specific support by developing methods usable in the assessment of psychosocial as well as biological determinants of behaviour; joint funding and utilization of field courses are further examples of ways in which this collaboration took place.



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